NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-768 (New 09-10)**

FLIGHT TRAINING INSTRUCTION

AIR FORCE ADVANCED FORMATION T-6B

2010

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
250 LEXINGTON BLVD SUITE 102
CORPUS CHRISTI TX 78419-5041

CNATRA P-768
N716
8 Oct 10

CNATRA P-768 (NEW 09-10)

Subj: FLIGHT TRAINING INSTRUCTION, AIR FORCE ADVANCED FORMATION, T-6B

1. CNATRA P-768 (New 09-10) PAT, "Flight Training Instruction, Air Force Advanced Formation, T-6B" is issued for information, standardization of instruction and guidance to all flight instructors and student aviators within the Naval Air Training Command.

2. This publication shall be used as an explanatory aid to the T-6B Joint Primary Pilot Training (JPPT) curriculum. It will be the authority for the execution of all flight procedures and maneuvers herein contained.

3. Recommendations for changes shall be submitted via CNATRA TCR form 1550/19 in accordance with CNATRAINST 1550.6 series.

4. CNATRA P-768 (New 09-10) PAT is a new publication.

Thomas E. Broderick
THOMAS E. BRODERICK
Chief of Staff

Distribution:
CNATRA N71 (10) Plus Original
TRAWING FIVE (100)

FLIGHT TRAINING INSTRUCTION

FOR

AIR FORCE ADVANCED FORMATION

T-6B

P-768

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0…08 Oct 10 (this will be the date issued)

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 92 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
COVER	0	7-1 – 7-13	0
LETTER	0	7-14 (blank)	0
iii - x	0	8-1 – 8-4	0
1-1 – 1-2	0	9-1 – 9-12	0
2-1 – 2-11	0	10-1 – 10-7	0
2-12 (blank)	0	10-8 (blank)	0
3-1 – 3-6	0	A-1 – A-2	0
4-1 – 4-10	0	B-1 – B-7	0
5-1	0	B-8 (blank)	0
5-2 (blank)	0		
6-1	0		
6-2 (blank)	0		

INTERIM CHANGE SUMMARY

The following changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

The following interim changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

COURSE OBJECTIVE:

Upon completion of this course, the Student Pilot will be able to safely pilot a T-6B in formation flight incorporating standard USAF formation procedures, terminology, and concepts. Student pilots will also be introduced to Air Force flying publications and the Air Force Pilot training environment.

INSTRUCTIONAL PROCEDURES:

1. This is a flight training course and will be conducted in the T-6B aircraft.

2. The student will demonstrate a functional knowledge of the material presented in this Flight Training Instruction manual and other various instructional references.

INSTRUCTIONAL REFERENCES:

1. T-6B NATOPS Flight Manual

2. OPNAV 3710.7 series

3. CNATRA P-766 Primary Formation FTI

4. Air Force Manual 11-205, Aircraft Cockpit and Formation Flight Signals

5. Air Force Manual 11-217V1, Instrument Flight Procedures

6. Air Force Manual 11-248, T-6 Flying Operations

7. VT-3 Standard Operating Procedures (SOP)

TABLE OF CONTENTS

TABLE OF FIGURES

CHAPTER ONE
INTRODUCTION TO AIR FORCE ADVANCED FORMATION

100. INTRODUCTION

This Flight Training Instruction (FTI) is a Naval Air Training Command directive in which the Chief of Naval Air Training (CNATRA) publishes information and instructions relative to all Instructors and Student Pilots operating the T-6B aircraft in USAF Advanced Formation flying. This manual builds on the basic techniques and procedures necessary to safely and effectively employ the T-6B in formation. The skills developed in this stage provide the foundation for all follow-on Air Force flight training.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER TWO
GENERAL FORMATION MISSIONS

200. INTRODUCTION

The primary purpose of flying formation is mutual support. However, the benefit of mutual support can only be achieved by meticulous adherence to the contractual obligations of Number 1 (Lead) and Number 2 (Wingman) presented in this FTI. Mission effectiveness is directly dependent on strict flight discipline. Flight discipline is demonstrated through precise adherence to mutually understood tasks identified in formation procedures, unit standards, and the preflight brief. Formation, more than any other type of flying, builds confidence, develops teamwork, and teaches self-discipline.

201. FLIGHT DISCIPLINE

Flight discipline requires an in-depth knowledge of flight rules, unit standards, and the procedures in this FTI. Additionally, it requires strict adherence to the plan given in the preflight brief and any real-time alterations directed by Number 1 during the flight. It begins with mission preparation and continues through the brief, flight, and debrief. As Number 2, strive to maintain position. As Number 1, correct any wingman deviations immediately by directing Number 2 to the proper position if appropriate corrections are not being made. Number 2 will query immediately if unsure of assigned position. Flight discipline is absolutely essential for successful mission execution.

202. RESPONSIBILITIES

Flight Lead (FL). The flight lead (section lead) is ultimately responsible for the safe and effective conduct of the mission. This position gives both the authority and the responsibility of ensuring mission success to one individual who will be clearly identified prior to the mission. The flight lead is responsible for the planning, brief, execution, and debrief of the flight. The flight lead may delegate some or all of these mission elements but retains overall responsibility. The flight lead does not change during a mission under normal circumstances.

Number 1 and Number 2. Within a two-ship formation (also referred to as an Element), there are two distinct roles with well-defined responsibilities: Number 1 and Number 2. Do not confuse the terms flight lead and Number 1. For the purposes of this manual, flight lead is defined as the instructor pilot with overall responsibility for the formation and its mission, while Number 1 is a position with a predefined set of responsibilities, priorities, and tasks being fulfilled within the formation.

1. **Number 1.** Number 1 is responsible for executing mission elements during the flight. Number 1's top priorities include clearing for the formation, planning, and monitoring Number 2. Plan all maneuvers to keep the flight well within the assigned working airspace. High performance and high-G maneuvers require smooth and deliberate control inputs to keep Number 2 from exceeding G limitations. Monitor Number 2 to ensure the correct position before the next maneuver.

a. **Clear for the Formation.** Includes deconflicting from other aircraft and maintaining a safe altitude above the ground or any obstacles.

b. **Plan Ahead of the Aircraft.** Includes altering the profile and maneuvers as appropriate and ensuring fuel and time are used judiciously to accomplish mission and training objectives.

c. **Monitor Number 2.** Includes ensuring Number 2 is in the assigned position. This also includes assessing parameters during maneuvers and prior to the execution of a new maneuver.

d. **Navigation.** Includes ensuring the formation is at the proper altitude, airspeed, and position relative to NAVAIDs, routing, instrument approaches, obstacles, airfields, etc.

e. **Communication.** Includes transmitting and receiving information for the formation. ATC treats the formation as a single entity with a single voice. Number 1 owns all the radios in every aircraft in the formation.

2. **Number 2.** Number 2's primary responsibility is to maintain flight path deconfliction and proper position as directed by Number 1. This includes providing mutual support and maintaining formation integrity by executing the plan as briefed, and accomplishing the tasks as directed by Number 1 without compromising safety. Number 2's top priorities include flight path deconfliction from Number 1, maintaining proper position relative to Number 1, and executing additional tasks as directed by Number 1. Use all of Number 1's aircraft as a reference; do not focus on just one spot. Whether the flight is taxiing out to the runway or flying up initial, Number 2 must look and sound sharp. Basic wingman responsibilities include:

a. **Do Not Hit Lead.** Flightpath deconfliction is paramount. Unless Number 2 has called blind (or for brief periods during tactical formation turns), Number 2 is responsible for deconflicting flightpaths.

b. **Keep Lead in Sight.** The key to avoiding collision is keeping Number 1 in sight. If Number 2 loses sight, he or she must call "blind" and execute the appropriate procedures.

c. **Be in Position and on Frequency.** This is commonly referred to as "being there." If Number 2 is in position and on frequency, it is much easier to keep Number 1 in sight and for Number 1 to monitor Number 2.

d. **Clear for the Formation.** Number 2 is able to clear quadrants that Number 1 cannot, such as Number 1's 6 o'clock. This is one of the primary advantages to flying in formation. Number 1 should put Number 2 in route, fighting wing or tactical, as appropriate, to ensure mutual support.

2-2 GENERAL FORMATION MISSIONS

e. **Back Up Lead.** A good wingman is ready to take the lead at a moment's notice to accomplish any tasks assigned by lead. Number 2 should strive to actively monitor navigation, communication, fuel state, mission accomplishment, etc. When Number 2 is able to consistently back up lead, it shows a readiness to become a flight lead.

203. COLLISION AVOIDANCE

Flightpath deconfliction is the most fundamental tenet of formation flying. Although Number 1 and 2 are both responsible for adequate separation, Number 2 has ***primary*** responsibility for flight path deconfliction within the Element unless Number 2 is unable to maintain visual contact. In that case, Number 2 conveys a blind status to Number 1. This responsibility does not transfer to Number 1 unless Number 2 calls "blind."

Military aviators use brevity code words to achieve clear, concise, correct, and effective communication. Common brevity code words which aid in collision avoidance include: blind, visual, no joy, tally, and padlocked. When referring to aircraft within the formation, use the terms blind (lack of visual contact) or visual (positive visual contact) as appropriate. When referring to aircraft outside of the formation use the terms no joy (lack of visual contact) or tally (positive visual contact). Padlocked indicates that the pilot cannot take his or her eyes off an aircraft (or ground object) without losing sight of it.

Number 2's highest priority is flight path deconfliction. Fulfillment of this responsibility is predicated on Number 2 maintaining visual contact with Number 1 at all times. Number 2 is always assumed to be visual while in formation unless a blind status is effectively transmitted, received, and acknowledged. An immediate blind call must be made with current altitude, *"Texan 2, blind, 9,000 feet."* Number 2 is then assumed to be blind until a visual status is effectively transmitted, received, and acknowledged. When Number 1 acknowledges the blind call, primary responsibility for flight path deconfliction shifts within the Element, and Number 1 is expected to talk Number 2's eyes back to a "visual" with Number 1. If Number 1 is also blind, Number 1 must immediately direct 1000 feet of altitude separation (minimum 500'). When Number 2 regains visual contact, he or she resumes primary responsibility for flight path deconfliction. Periodic cross-check of Number 2's position will ensure that Number 1 does not execute a maneuver that will compromise safety. Some factors that may increase the potential for a midair collision include:

1. Failure of Number 1 to properly clear or visually monitor Number 2 during a critical phase of flight, such as a rejoin or the Extended Trail (ET) exercise. Number 1 must visually monitor Number 2, either directly or with the use of the mirrors. Number 1 must be directive or take evasive action if Number 2 loses sight. If Number 1 loses sight and is uncertain of Number 2's position, he or she should query Number 2 by requesting, *"Texan 2, posit."* The "posit" call is a question as to the position of Number 2 relative to Number 1, *"Texan 2, 6 o'clock, low, 300 feet."*

2. Failure of Number 2 to execute lost wingman procedures promptly and correctly if visual contact is lost in IMC. In IMC, if Number 2 cannot maintain the normal close (fingertip) position (using normal visual references) or loses sight of Number 1, initiate appropriate lost wingman procedures.

3. Failure to recognize excessive overtake. During rejoins, compare actual airspeed with the directed airspeed. Use power and speed brake as necessary. Number 1 should direct an overshoot or breakout if necessary.

4. Failure to maintain lateral or vertical separation. For turning or straight-ahead rejoins, Number 2 must maintain lateral or vertical separation until closure rates are under control and stabilized in route.

5. Failure of Number 2 to call blind and maneuver in the safest direction when visual contact is lost. Number 2 calls blind if visual contact with Number 1 is lost for any reason (other than in IMC). If deconfliction is questionable or if the blind call is not acknowledged, break out of formation.

6. Failure to consider the effects of wingtip vortices. Number 2 may fly into vortices when too close during close (fingertip) or crossunder. Control difficulties associated with wingtip vortices are very dangerous. If encountered, control the aircraft and move back out or break out as necessary.

204. MISSION PLANNING/BRIEF

Mission Planning. The Flight Lead (FL) establishes priorities for mission planning and delegates tasks to flight members to ensure thorough planning without duplication of effort. All flight members should be involved in the mission preparation. The level of planning detail is dictated by mission specifics and pilot experience level, but all necessary mission planning must be completed in time to conduct a concise, comprehensive mission brief.

Mission Brief:

Objective. The FL (or designated briefer) ensures all flight members are briefed on start, taxi, takeoff, recovery, and relevant aspects of the flight.

Description. The brief sets the tone for the entire mission. The brief should set objectives, establish goals and set the standard used to measure successful performance during the mission.

Procedure. All formation members should be present for the preflight brief. The brief should be conducted in a professional manner and should be clear and concise. The majority of the preflight brief should be spent describing the "how to" of the mission.

Crew Briefs. The briefer must allow time for each crew to discuss intercockpit responsibilities, emergency procedures, and other crew coordination issues.

2-4 GENERAL FORMATION MISSIONS

Mission Debrief. The debrief should cover areas that need improvement. Conduct the debrief in a business-like atmosphere. Critiques on performance should not be taken personally. Receive instruction openly; use the debrief as a tool for improvement.

205. RADIO DISCIPLINE

Clear, concise, correct communications are a good indicator of flight discipline. Minimize and combine radio calls on common-use frequencies to reduce radio congestion. When communicating with agencies outside the formation, Number 1 will speak for the flight until the formation splits up (unless briefed or directed otherwise).

Number 1 owns the radios; which means Number 2 will only change frequencies when directed by Number 1. If Number 1 uses the term *"go"* for a frequency change, Number 2 will acknowledge before changing the frequency. If Number 1 uses the term *"push,"* Number 2 should change to the new frequency without acknowledging. When referring to VHF frequencies, Number 1 will add the suffix "victor." For example:

"Texan go channel 5"; acknowledge "2"

"Texan push channel 5"; no acknowledgment

"Texan, go channel 2 victor"; acknowledge "2"

If Number 1 sends Number 2 to the wrong frequency, Number 2 should go to that frequency and wait. Number 1 will get Number 2 on the proper frequency either using the radio or using visual signals. Number 2 should never change frequencies without being directed by Number 1 and Number 2 should not go hunting for Number 1 (if Number 1 and Number 2 end up on different frequencies).

Normally, when in close (fingertip) formation, wingmen will automatically move to the route position when Number 1 directs a channel change, and they will return to close (fingertip) position after being checked in on the new frequency. If in a position wider than close (fingertip), wingmen will remain in that position unless directed by Number 1. If in IMC or simulated IMC, wingmen will maintain close (fingertip) spacing and use the crew concept to accomplish frequency changes. The pilot flying (PF) talks on the radio and the pilot not flying (PNF) accomplishes the frequency change. If solo and in IMC, change frequency when workload permits. Wait until VMC, if necessary, and use the intraflight radio to communicate within the formation.

When filling the Number 1 position, do not use the term "lead" when referring to own ship parameters, use "1." For example, *"Texan 41 ops check, 1 is 600, 4 Gs."* The only time the term "lead" should be used over the radio is when executing a lead change. For example, *"Texan 2, you have the lead on the right"*.

Timing, tempo, intonation, syntax, and format should mirror Number 1 and should provide accurate information. For example, Number 1 says *"Texan 41 ops check, 1 is 700, 4.3 Gs."* Number 2 responds with the same format *"2 is 600, 3.7 Gs."* Wingmen will normally respond to

all directive calls unless briefed otherwise. If a radio call is unclear, Number 2 will query Number 1.

For traffic calls, transmit call sign, traffic direction (left or right), clock position, elevation (low, level, or high), and approximate distance. For example, *"Texan 1, traffic right, 2 o'clock, slightly high, 3 miles."*

206. WAKE TURBULENCE

Air Force Advanced Formation sorties are flown in a variety of flight regimes resulting in rapidly changing G forces. Any time Number 2 is maneuvering behind Number 1, Number 2 must use caution to avoid areas of prop wash or wake turbulence. Any time wake turbulence or prop wash are encountered; Number 2 should unload to approximately 1 G, exit the area of turbulence, and check the G meter. If the aircraft G limits have been exceeded, the formation will terminate maneuvering and conduct a controllability check, as required.

207. KNOCK-IT-OFF (KIO) & TERMINATE PROCEDURES

KNOCK-IT-OFF

Objective. Cease tactical maneuvering.

Description. KIO is used when safety of flight is a factor or when doubt or confusion exists.

Procedure. The procedures for KIO and terminate are very similar. Aircraft with radio failure signal KIO with a continuous wing rock. Another aircraft observing a continuous wing rock should transmit KIO and provide assistance as required. Any member of the formation may initiate a KIO:

"Texan, knock-it-off." Number 1 acknowledges, *"Texan 1, knock-it-off,"* followed by Number 2, *"Texan 2, knock-it-off."* Number 2 should then await directions from Number 1. Number 1 continues the current maneuver without changing power setting. This ensures predictability and aids in flight path deconfliction. Flightpath deconfliction should be the primary concern for all aircraft. If an aircraft loses sight, the aircraft losing sight should make the appropriate "blind" radio call. Upon hearing a KIO call or observing a continuous wing rock, all participating aircraft will:

1. Clear the flight path.

2. Cease maneuvering.

3. Acknowledge with a call sign in order of position in formation, or with a wing rock if the radios have failed.

4. Obtain verbal clearance before resuming maneuvers.

Knock-it-off criteria *ACURA NORDO BINGO DRAW*

A - Area boundaries being approached

C - Cloud minimum clearances approaching

U - Unauthorized flight enters the area

R - Rocking of wings

A - Awareness (Situational) is lost

NORDO - Radio failure is recognized

BINGO - Bingo or minimum fuel is reached

D - Dangerous situation is developing

R - Range (minimum) is approached

A - Altitude minimums being approached

W - Weather is below minimums

If given a KIO, acknowledge the call and cease maneuvering, adhere to deconfliction responsibilities until separation is assured, then direct a rejoin.

TERMINATE. Used to direct a specific aircraft or flight to cease maneuvering, clear the flight path, and proceed as briefed or directed. Use terminate to cease maneuvering when Number 2 has met the desired learning objectives, or if Number 2 is outside position parameters (desired learning objectives are not achievable). The terminate call is acknowledged in the same manner as a KIO call. For example, *"Texan terminate," "Texan 1 terminate," "Texan 2 terminate."* Number 1 smoothly transitions to a shallow turn or level flight until Number 2 has attained the desired formation parameters. Once back in position, Number 2 may signal for continued maneuvering by calling, *"Texan 2, in."* At this point, Number 1 may continue maneuvering or direct the formation, as desired. Any member of the formation can make these calls.

208. VISUAL SIGNALS

Objective. Relay information between flight members or direct maneuvers.

Description. Visual signals are used when radio transmissions are inappropriate or difficult to make. Visual signals are described in Appendix B of this FTI.

Procedure. As Number 2, acknowledge with a head nod when Number 1 gives a signal. If unsure of a signal, Number 2 should not acknowledge or change position. Number 1 repeats the signal until an acknowledgment is received. Use the radio, if necessary, to immediately clear up any confusion.

Only the pilot at the controls should give or acknowledge visual signals. Visual signals must be clear, appropriate, and proportional to range. For example, a slight wing rock is appropriate

from a two-ship-width route versus a large wing rock from a 500-foot route. Brief any nonstandard visual signals before they are used.

209. FUEL PLANNING

Objective. Monitor fuel status of all aircraft in the formation.

Description. All flight members must understand how to determine Joker and Bingo. Flight members should increase the frequency of fuel checks during high fuel flow operations (Extended Trail, low altitude) and when approaching Joker or Bingo.

Procedure. Number 1 must continually monitor the flight's fuel state and adjust the profile as necessary. Unless already on the recovery, Number 2 will inform Number 1 when reaching Joker or Bingo. If fuel drops below Joker, Number 2 will reference the fuel state from Bingo. For example, *"Texan 2 is Bingo plus 100."* Number 1 must also take action when any aircraft exceeds G limitations, reaches Joker or Bingo fuel, or reports an abnormal fuel condition. Number 1 must initiate a fuel and G check periodically throughout the mission.

210. FENCE CHECK

A FENCE check is typically performed when entering or exiting a hostile area. It ensures aircraft systems are set for combat. During training, a FENCE check will be performed when entering the MOA (FENCE-in) and again when leaving the MOA (FENCE-out). The FENCE check will be performed IAW the T-6B Primary Formation FTI.

211. LOST WINGMAN PROCEDURES

Objective. Gain immediate separation of aircraft when Number 2 loses sight of Number 1 in IMC.

Procedure. Perform IAW the T-6B Primary Formation FTI.

212. FORMATION BREAKOUT

Objective. Ensure immediate separation and avoid midair collision.

Description. The **HITS** technique is used when Number 2's presence constitutes a **H**azard to the formation, is **I**n front of Number 1, directed (**T**old) to break out, or has a loss of **S**ituational Awareness. Number 2 should break out of the formation to obtain immediate separation.

Procedure. When breaking out, Number 2 clears in the direction of the break and maneuvers away from Number 1's last known position (or in the direction that ensures immediate separation). Use power and speed brake as required to maintain safe maneuvering airspeed to expedite separation. When able, Number 2 informs Number 1, "*Texan 2 is breaking out*." Number 1 continues to fly predictably, and if the Number 2 is in sight, maneuvers as necessary to deconflict flightpaths.

During a breakout, it is possible to lose sight. All flight members must remain vigilant to ensure deconfliction. A breakout does not always require an abrupt, high-G turn away from Number 1. If Number 2 initiates the breakout, it is that aircraft's responsibility to maintain safe separation until Number 1 acknowledges the breakout, confirms visual contact, or establishes altitude separation. If Number 1 directs the breakout, Number 1 is responsible for safe separation and deconfliction until acknowledgement, visual contact, or altitude separation. An aircraft that has left the formation may not rejoin until directed by Number 1.

213. LOST SIGHT PROCEDURES (VMC)

Objective. Flightpath deconfliction and notification of a lost sight condition.

Description. When one aircraft loses sight of another (usually Number 2 loses sight of Number 1), the formation must achieve minimum vertical separation, then rejoin after visual contact is regained.

Procedures. If visual contact with Number 1 is lost, Number 2 will notify Number 1 and state current altitude, *"Texan 2, blind, 17,000 feet."* If there is no timely acknowledgement of the "blind" call, Number 2 will maneuver away from the last known position of Number 1 and alter altitude. In some cases, heading or turn information may also be appropriate for this call, *"Texan 2, blind, 17,000 feet, right turn through heading 130."* If Number 1 maneuvers into the sun, Number 2 may lose sight. Although visual contact is usually regained within moments, a momentarily blind condition could pose a great hazard for midair collision. The formation member with visual contact transmits a relative position to the "blind" aircraft. For example, *"Texan 1, visual, right, 2 o'clock, high."* If Number 1 is "blind," but Number 2 has Number 1 in sight, Number 1 has the option to direct a rejoin. In this case, Number 2 does not rejoin closer than a route position until Number 1 calls "visual." If Number 2 is "blind," and Number 1 has Number 2 in sight, Number 1 maneuvers to ensure separation between the two aircraft. If both aircraft have lost sight of each other, Number 1 must immediately direct a 1,000 feet altitude separation (500 feet minimum). Until visual contact is regained, Number 1 must take positive action to ensure flight path deconfliction. Both formation members maintain this separation until visual contact is regained and a rejoin is initiated. In some cases, losing sight of the other aircraft does not require a breakout or lost wingman procedure because sufficient spacing may already exist.

214. LEAD CHANGES

Objective. Transfer of lead position.

Description. Any transfer of responsibilities needs to be clearly understood by the entire formation. Lead changes result in a clear transfer of specific responsibilities from one flight member to another.

Admin Lead. Use Admin Lead to pass lead responsibilities to another member of the flight. The Admin Lead is expected to run all aspects of the profile to include navigating, managing radios, and making changes to the profile if external conditions dictate. With an admin lead

change, the call signs within the flight are administratively renumbered to match the position being flown. However, the Flight Leader still retains ultimate authority and responsibility for the formation.

Nav Lead. Nav Lead may be used when Number 1 wants Number 2 to navigate and clear. Call signs are not administratively renumbered. Number 1 will deconflict flightpaths within the flight and fly the Number 2 position but will maintain control of the radios.

Procedure. If in close (fingertip), Number 1 will direct Number 2 to route and call or signal for the lead change. Number 2 will assume route position near line abreast (LAB). If the formation is already in route or greater spacing, Number 1 may use the radio to transfer the lead. Number 2 will acknowledge the lead change and become the new Number 1, regardless of the method of lead transfer (visual signal or radio call). If Number 1 uses visual signals, Number 2 will acknowledge with visual signals. If limited visibility is an issue, use the radio to execute the lead change.

In wings-level flight, Number 2 assumes the LAB route position. If Number 1 uses a radio call, Number 2 acknowledges the call and becomes the new Number 1. If Number 1 uses a visual signal, Number 2 acknowledges with a head nod and becomes the new Number 1. It is not necessary for Number 2 to be on or forward of the 3/9 line to take the lead. Number 2 need only be in a position to safely lead the flight when taking over the lead. The lead change is not complete until Number 2 acknowledges it. The new Number 1 should establish a power setting to aid the new Number 2 in moving to the proper position.

For an Admin Lead change, the new Number 1 turns the TCAS on and switches the transponder to active after assuming the lead. The new Number 2 turns the TCAS to STBY and switches the transponder to STBY following the lead change. The new Number 2 will maintain route until directed otherwise. For a Nav Lead change, Number 1 maintains callsign, squawk and TCAS.

215. AIRBORNE EMERGENCIES (GENERAL)

Maintain formation integrity to the maximum extent possible during airborne emergencies. Mutual support is one of the primary reasons for formation flight. If either member of the formation must return to the airfield early, the other aircraft should normally return and provide assistance. The FL may make exceptions to this if the problem is minor and the field is in sight or if the weather conditions would complicate a safe formation return. If an aircraft malfunction occurs while in fingertip, increase aircraft separation before handling the emergency, weather permitting. The formation member with an abnormal situation advises other members in the formation of the problem, intentions, and assistance needed.

1. **Number 1.** In general, the aircraft with a malfunction should be given the Number 1 position. This allows the affected aircraft to handle the emergency without the requirement to maintain position. The Number 1 position should be offered three times:

a. When the emergency occurs.

b. On recovery, when below the weather and able to navigate to the field VFR.

c. When on final with the field in sight, cleared to land.

Except in IMC, avoid flying closer than route formation as Number 2. If Number 2 refuses the Number 1 position at any time, offer it at each successive point as described above. Except in very unusual circumstances, do not attempt to land in formation with a disabled aircraft. If Number 2 is able to communicate over the radio, offer verbal assistance as necessary.

2. **Number 2.** When a malfunction is discovered, call KIO, and inform Number 1 of the problem. If able, take the Number 1 position when offered. Generally, avoid flying Number 2 position with an emergency. Avoid flying closer than route spacing.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER THREE
CONCEPTS & TERMINOLOGY

300. INTRODUCTION

Slightly different formation concepts and terminology used by the USAF will be introduced in the Air Force Advanced Formation stage of training.

Aggressiveness - A state of mind, not to be confused with abrupt flight control movement or reckless abandon. Aggressiveness means knowing the rules and parameters, recognizing deviations, and making expeditious, controlled corrections.

Stabilized - In control and able to complete the maneuver safely within the pilot's capabilities. In this FTI, Number 2 is often directed to stabilize before continuing a maneuver. For example, Number 2 must stabilize in route before continuing to close (fingertip) during a rejoin.

301. HEADING CROSSING ANGLE & ASPECT ANGLE

Heading Crossing Angle (HCA). The angular difference between the longitudinal axes of two aircraft. HCA is also synonymous with the term angle off.

Aspect Angle (AA). The angle measured from the tail of one aircraft to the position of another. AA is independent of aircraft heading. Aspect is expressed in degrees off the tail of the reference aircraft, commonly expressed in multiples of 10. For example, at 6 o'clock to the reference aircraft, the aspect is zero. At 40 degrees left, the aspect is "4L." AA is not a clock position. Two important AAs used extensively in T-6B training are 30 and 45 degrees.

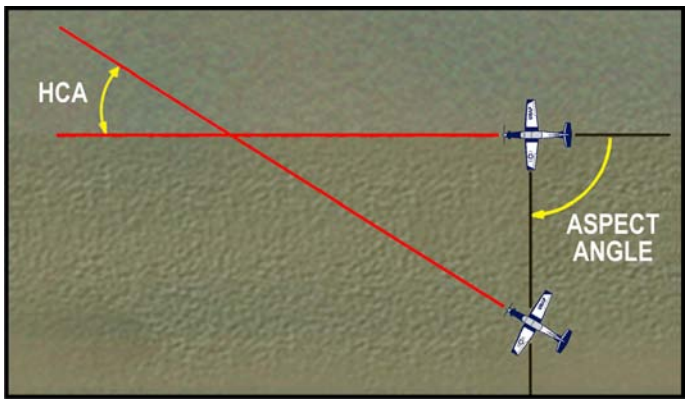

Figure 3-1 Heading Crossing Angle and Aspect Angle

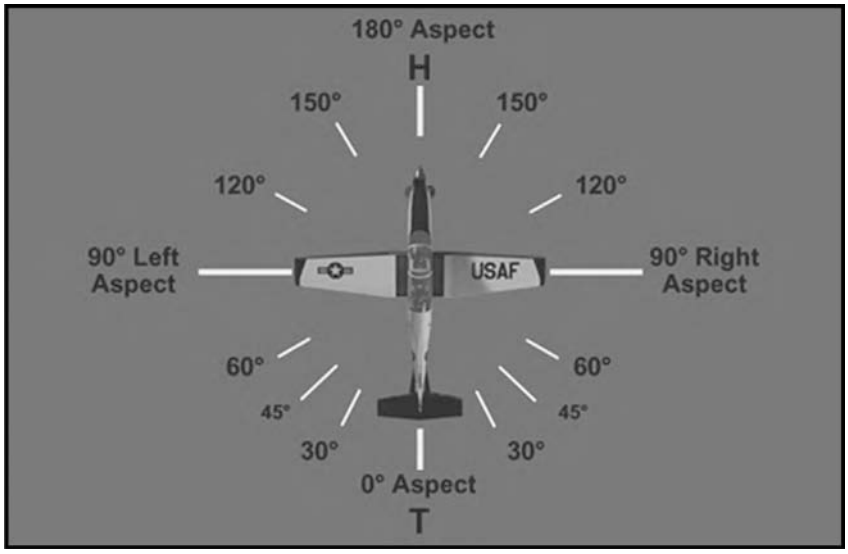

Figure 3-2 Aspect Angle

302. LIFT VECTOR AND VELOCITY VECTOR

Lift Vector. The lift vector is the aerodynamic force that equals the total lift in the z-axis perpendicular to the aerodynamic chord, originating at the aerodynamic center of pressure. It varies in magnitude, based on G load, but is always positioned straight out through the top of the canopy. In the T-6B, use the CFS chord as a reference to indicate where the lift vector is pointed. Control the position of the lift vector by using ailerons to set the wing position. Control the magnitude of the lift vector by adjusting the amount of back stick pressure to vary G load.

Velocity Vector. Where the aircraft is going. Approximated by aircraft nose or exacted by the flight path marker in the HUD. Control placement of velocity vector using flight controls. The magnitude of the velocity vector is controlled by changing airspeed.

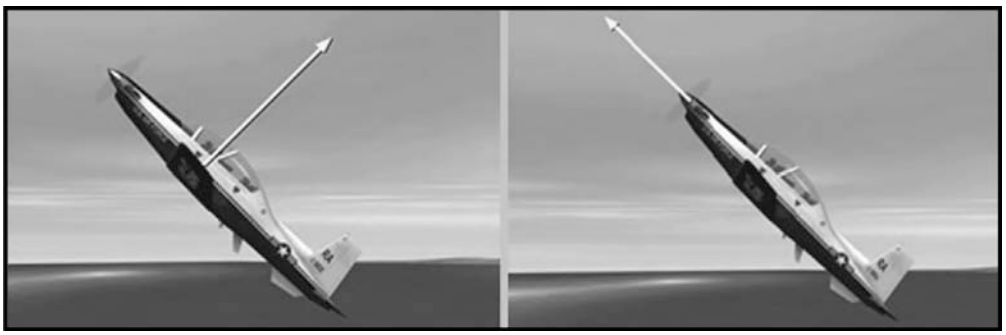

Figure 3-3 Lift and Velocity Vectors

Line of Sight (LOS). A straight line from the pilot's eye to another aircraft or object in question.

LOS Rate. Change of LOS. Speed of apparent movement of another aircraft in relation to one's own aircraft as measured by visually assessing direction of movement across the canopy. Commonly expressed as forward LOS (other aircraft moving forward on canopy toward the nose) and aft LOS (other aircraft moving aft on the canopy toward the tail).

303. PLANE OF MOTION

Plane of Motion (POM). The plane containing the aircraft flight path. In a level turn, aircraft's POM is horizontal regardless of bank angle. In a loop the POM is vertical.

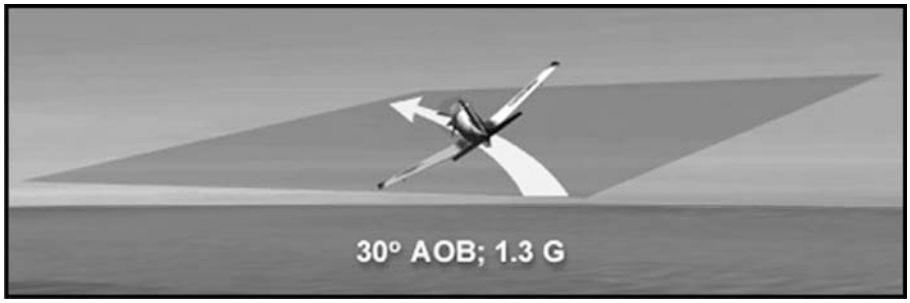

Figure 3-4 Plane of Motion

304. LEAD/LAG/PURE PURSUIT

The concepts of lead, lag, and pure pursuit introduced in basic formation are the same applied throughout aviation. In Air Force Advanced Formation training, dynamic maneuvering can shift the POM to the vertical requiring the same use of lead/lag/pure pursuit curves. It can also apply in the realm of G loading. "Lag in G" might simply require less G around the turn circle. This training is an exposure to these concepts.

Lead Pursuit Picture. In the same or parallel POM, the lead pursuit picture creates pursuit geometry that occurs with nose pointed in front of the other aircraft. With enough lead pursuit, AA and closure will increase, and HCA will decrease. Various lead pursuit pictures may result in aft LOS, no LOS, or minimal forward LOS, depending on the magnitude of lead pursuit and other parameters such as relative airspeed and G. There are an infinite number of lead pursuit pictures.

Pure Pursuit Picture. In the same or parallel POM, the pure pursuit picture creates pursuit geometry that occurs with nose pointed at the other aircraft. A pure pursuit picture initially creates closure that diminishes over time. AA equals HCA, and both diminish over time. When established in a pure pursuit picture, there is no LOS; the other aircraft remains stationary in the canopy fixed at 12 o'clock along the longitudinal axis of the aircraft. There is only one pure pursuit picture.

Lag Pursuit Picture. In the same or parallel POM, the lag pursuit picture creates pursuit geometry that occurs with the nose pointed behind the other aircraft. In this case, closure decreases, AA decreases, and HCA increases.

	Pursuit Curve	HCA	Closure	Aspect Angle
1	Lead	Decreases	Increases	Increases
2	Pure	----------	Increases	----------
3	Lag	Increases	Decreases	Decreases

Figure 3-5 Pursuit Curve Relationships

305. AIRCRAFT 3/9 LINE

Aircraft 3/9 Line. This is an imaginary line extending from the aircraft's lateral axis (parallel to the wings and perpendicular to the fuselage). Number 2 should normally remain aft of Number 1's 3/9 line during maneuvering. This line equates to a 90 degree AA (9 aspect).

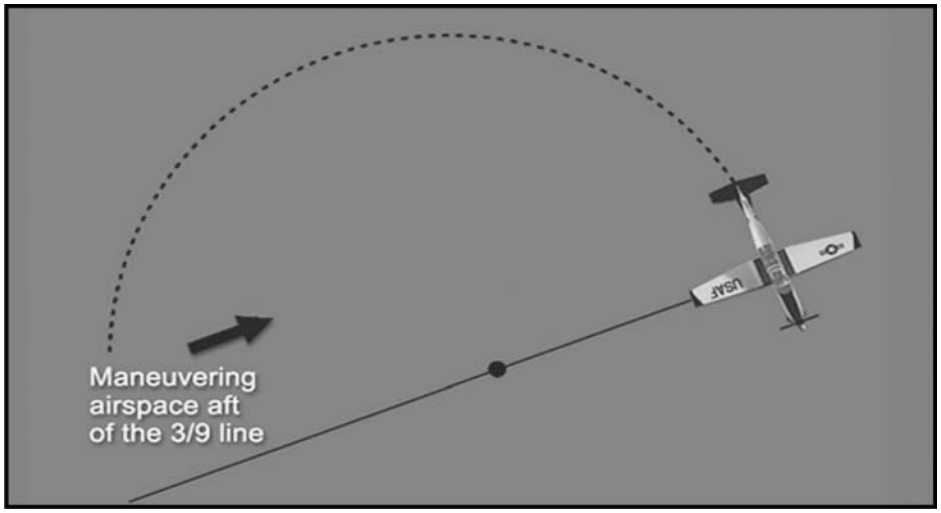

Figure 3-6 Aircraft 3/9

Turn Circle. Concept associated with POM. As an aircraft maneuvers, the flight path describes an arc. The center of this arc is the center of the turn circle. In the T-6B, turning room is mostly used aft of the 3/9 line. At 10,000 feet, 30 degrees angle of bank, and 180 KIAS, the radius of the T-6B turn circle is approximately 8,000 feet.

Turn Rate. This is the rate of change of heading (nose track), normally measured in degrees per second. At 10,000 feet, 30 degrees angle of bank, and 180 KIAS, the T-6B turn rate is approximately 3 degrees per second.

Turning Room. This is the volume of airspace (vertical and horizontal) that is available to execute maneuvers that change AA, angle off, and closure.

Safe Airspace. Safe Airspace is an area where any immediate threat of collision between aircraft in the formation is generally not feasible due to out-of-plane considerations and the resultant flight path vector of each aircraft.

306. LAG REPOSITION

Lag Reposition A lag reposition is a reposition of Number 2's aircraft that uses various combinations of pursuit curves and a move out-of-plane above Number 1's POM to control closure and AA to prevent a potential 3/9 line overshoot. It creates turning room by using the vertical POM (out-of-plane).

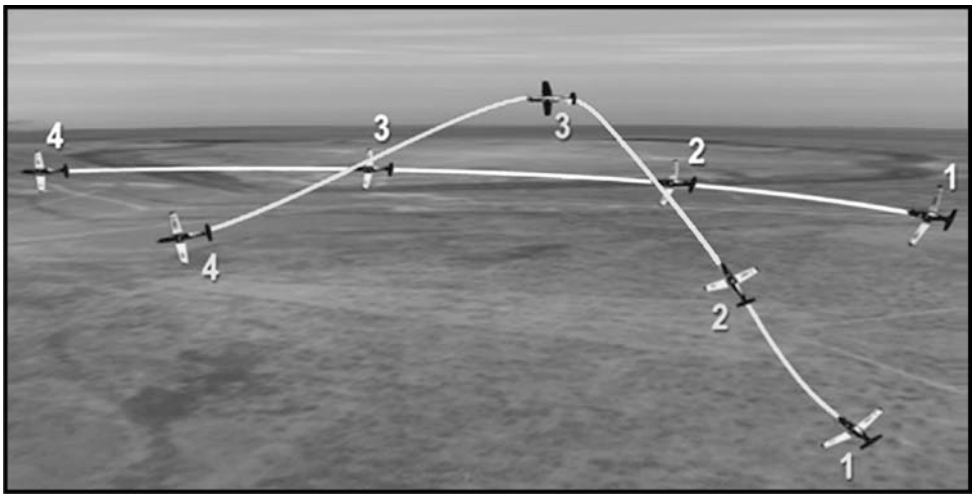

Figure 3-7 Lag Reposition

307. QUARTER PLANE

Quarter Plane. A quarter plane is an aggressive, last ditch out-of-plane lag maneuver used to control closure and aspect in order to preserve the 3/9 line. In a true quarter plane, Number 2 establishes a POM that is 90 degrees to Number 1's POM. This situation may be caused by a late decision (or no decision) to execute a lag reposition or a failure to control closure and aspect. Indicators that a quarter plane is needed are similar to those of a lag reposition. However, AA, HCA, range, and closure cues are more significant and require a much more aggressive maneuver than a lag reposition.

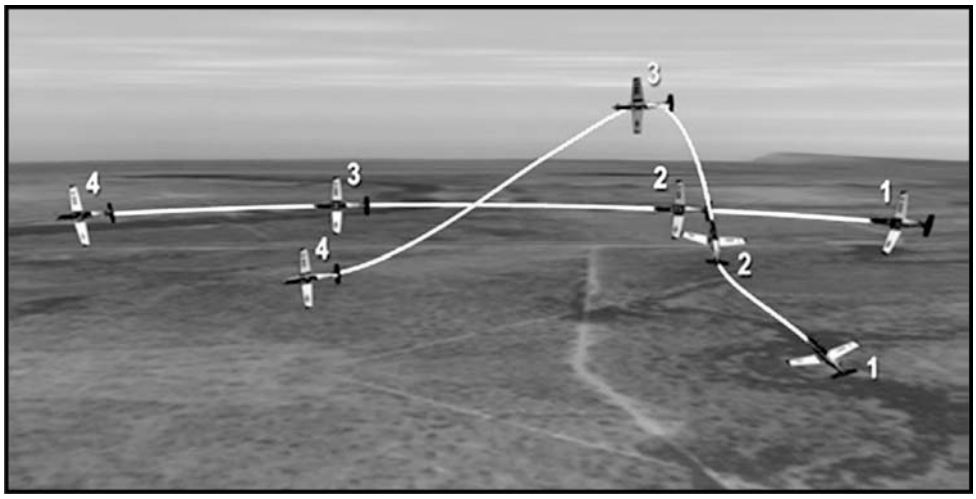

Figure 3-8 Quarter Plane

308. LEAD REPOSITION

Lead Reposition. A lead reposition uses various combinations of pursuit curves and a move out-of-plane below Number 1's POM to increase closure and AA.

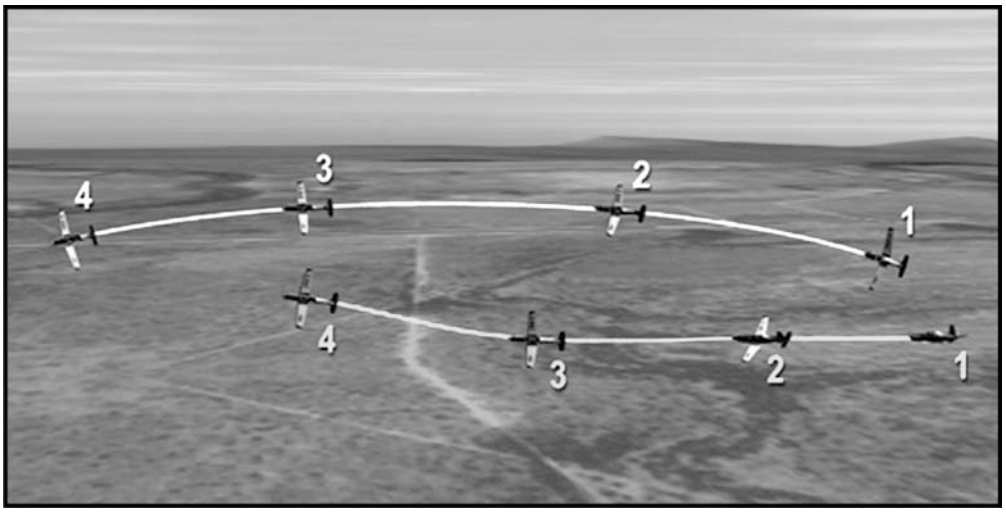

Figure 3-9 Lead Reposition

CHAPTER FOUR
BASIC FORMATION FUNDAMENTALS

400. INTRODUCTION

This Chapter covers some basic formation fundamentals introduced in the Air Force Advanced Formation stage of training.

Standard Formation. A standard formation is defined as a formation that maintains spacing within 6000 feet laterally and +/-100 feet vertically. If not within these parameters, notify ATC that the formation is "non-standard."

401. CLOSE/FINGERTIP

Objective. This position is the basis of all formation flying.

Description. Close formation is commonly referred to as fingertip. The Navy refers to it as Parade position. The close (fingertip) position will be flown the same as parade position IAW the T-6B Primary Formation FTI. Close (fingertip) formation is primarily used for weather penetration, airfield arrivals, departures, flyovers, and aerial demonstrations. Number 1 executes a shallow wing rock to direct Number 2 to close (fingertip) from route.

Procedure. In close (fingertip), Number 1 will be a smooth, stable platform, and Number 2 will maintain proper position.

402. ROUTE

Objective. Increase flight maneuverability while enhancing clearing and visual lookout.

Description. Route is a wider extension of close formation spacing and is flown to enhance clearing and visual lookout, increase flight maneuverability, and ease the completion of in-flight tasks. Number 1 sends Number 2 to route with a radio call or visual signal. With the formation in route, Number 1 should restrict maneuvering to moderate turns and pitch changes. Maximum bank angle in route is 60 degrees.

Route Spacing. Route spacing can be between two-ship widths and 500 feet. Route is flown no further forward than Line Abreast (LAB) and no further aft than the extended close (fingertip) reference line. When not in a turn, Number 2 generally maintains a position level with Number 1 (a level stack) by keeping the helmet of Number 1's FCP (Front Cockpit Pilot) on the horizon. Although the formal definition of the route position has fairly wide tolerances, Number 2 should strive to maintain a specific position when in route.

Route LAB. Typically, route is flown LAB when weather conditions are not a factor, and when visual clearing, flight path deconfliction and maneuvering are a priority. When LAB, strive to remain between the extended 3/9 line and 10 degrees aft of LAB (Number 1 is off the shoulder or the wingtip of Number 2). Normally, route LAB is flown out toward the 500 foot limit to enhance formation visual clearing and maneuverability.

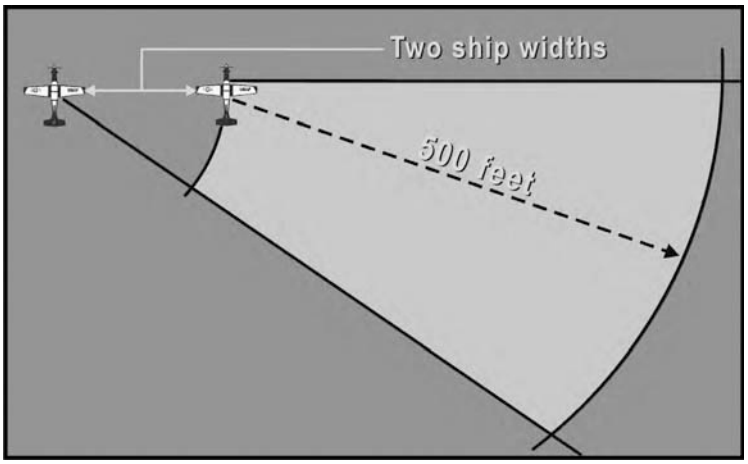

Figure 4-1 Route

Turns In Route. On the inside of the turn, Number 2 may need to maneuver slightly behind the close (fingertip) line to maintain spacing and keep Number 1 in sight (the Rear Cockpit Pilot [RCP] may lose sight of Number 1 first due to the position of the wing). When inside a turn, Number 2 maneuvers below Number 1's POM only as necessary to keep Number 1 in sight just above the canopy rail. On the outside of a turn, Number 2 maintains the same vertical references used in echelon turns (VFR turns away). Number 2 will not cross to the opposite side unless specifically directed to do so by a Number 1.

Procedure. Number 2 stabilizes in route before diverting attention to change radio channels, accomplish in-flight checks, or execute other cockpit tasks.

1. Number 2 automatically moves to route for radio channel changes unless weather conditions are a factor or simulating IMC training. For radio channel changes, in-flight checks and lead changes, Number 2 flies route at two to four ship widths spacing unless briefed otherwise to expedite anticipated position change back to close (fingertip) following these tasks.

2. During rejoins, Number 2 stabilizes in route spacing at two to four ship widths before assuming close (fingertip). Number 2 should maintain two to four ship widths route spacing when anticipating cockpit visual hand signals or resumption of close (fingertip) for weather.

3. Number 1 executes a shallow wing rock to direct Number 2 to move closer in route. A wing rock with no other signal from Number 1 directs Number 2 to close (fingertip).

As route spacing increases from two-ship widths to 500 feet, it is increasingly difficult to see references for the close (fingertip) line. Visualize two aircraft between Number 1 and Number 2 to approximate the inner limit of route. Between 300-500 feet, normal close (fingertip) references begin to fade. At 500 feet, the other aircraft will appear to be four times the size of the anti-collision strobe flash guard on the wingtip of your own aircraft.

403. CROSSUNDER

Objective. A crossunder is used to reposition Number 2 from one side of the formation to the other.

Description. A crossunder may be accomplished with the formation in close (fingertip) or route formation. Number 2 maintains nose-tail separation while crossing under. Number 1 directs a crossunder with a radio call or visual signal. The visual signal is a rapid, shallow wing dip in the desired direction of the crossunder. The size of the wing dip should be proportional to Number 2's spacing.

Procedure. Execute IAW Formation FTI.

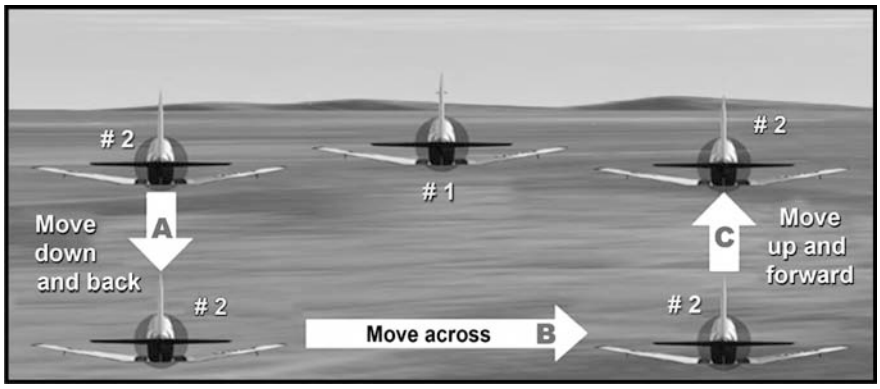

Figure 4-2 Crossunder

404. ECHELON TURN

Objective. Turn the formation while in close or route.

Description. A turn in which Number 2 remains in the same POM as Number 1. Echelon turns may be accomplished from close (fingertip) or route. All turns while in route position will be echelon turns (echelon signal not required). Turns while in close (fingertip) position will be flown as echelon turns only when signaled. Echelon turns are similar to USN/USMC VFR turns away.

Procedure. Instead of maintaining close (fingertip) references, Number 2 remains in the same POM as Number 1. Number 1 should roll smoothly into bank (60 degrees maximum AOB) and maintain appropriate back pressure. Slight variations in bank angle to control undesired climbs and descents are smoother and easier for Number 2 than variations in back pressure. Number 1's roll rate should approximate that used during instrument conditions. Number 2 matches Number 1's roll rate and uses back pressure to maintain spacing. In a level turn, the horizon bisects Number 1's fuselage. If out of position, use bank to correct vertical (to keep Number 1's fuselage bisecting the horizon), power to correct fore and aft position, and back pressure to maintain spacing. During rollout, Number 1 should use a smooth roll rate and gradually reduce back pressure. Number 2 matches Number 1's roll rate to maintain position.

In the front cockpit, one-half of the yellow rescue door should be visible (resembles a triangle) behind the aft edge of Number 1's wing.

Figure 4-3 Echelon Turn

405. PITCHOUT/TAKE SPACING

Objective. Provide spacing for rejoin practice.

Description. Normally, a level 180 degree turn is performed sequentially by the members of a formation to provide spacing between them. It is similar to breakup and rendezvous procedures.

Procedure:

1. **Number 1.** Direct a pitchout with a visual signal or radio call. Clear in the direction of the desired turn and begin a turn away from Number 2, using approximately 60 degrees of bank and sufficient G to establish the desired airspeed. Normally, fly a level turn for 180 degrees. Slight climbs or descents are acceptable for energy management. The degrees of turn may be adjusted for weather, area orientation, and energy management. Clearing the airspace takes priority over precise altitude control or rollout heading. Allow enough time for Number 2 to complete the pitchout before directing the rejoin.

2. **Number 2.** Delay 2 to 3 seconds or as briefed. This should provide approximately 500 to 1,000 feet of separation at rollout, then turn to follow Number 1. A 5 to 7 second delay will result in approximately 1,500 to 2,000 foot spacing. After approximately 90 degrees of turn, vary bank and back stick pressure to attain desired spacing and roll out behind and slightly below Number 1. Place Number 1 approximately one to two ship widths above the horizon. Rejoin when directed.

Take Spacing. Take spacing is used to put Number 2 in a trail position when a pitchout is not practical. Number 1 directs Number 2 to take spacing with a radio call. The radio call is, *"Texan 2, take spacing."* Spacing can be achieved with a combination of maneuver and deceleration by Number 2 and/or acceleration by Number 1. One option is for Number 1 to accelerate and direct Number 2 to take spacing. Number 2 reduces power and/or uses speed brake to slow and increase spacing. At the desired range, Number 2 may call *"ready,"* or Number 1 may direct a rejoin after a suitable delay. Number 1 then slows and directs a rejoin. Another option is for Number 2 to take spacing by performing a series of "S" turns behind and below Number 1's prop wash. Do not exceed the limits of standard formation (100 feet vertical and 6,000 feet horizontal) if outside the MOA.

406. REJOINS

Objective. Repostion the flight back together safely and efficiently.

Description. Rejoins are commonly practiced from pitchouts after Number 2 has taken spacing. They are also accomplished after breakouts, practice lost wingman, instrument trail departures, and lost-sight situations (basically, anytime the formation is split). A ***reform*** is used to move Number 2 from one formation position to another, as in the reform from fighting wing to close (fingertip) or route.

Procedure. Number 1 initiates rejoin with radio call or visual signal. Number 1 may use slight climbs or descents during a rejoin when necessary for energy management or area orientation. Number 1 should consider using a radio call to initiate a rejoin when Number 2 is not in sight. All rejoins are to close (fingertip) position unless directed otherwise by Number 1. Number 1 directs a rejoin and reform with a radio call or visual signal (wing rock). The size of the wing rock is based on distance between aircraft. Number 1 should monitor Number 2 closely during all rejoins. If Number 1 perceives an unsafe situation developing at anytime during the rejoin, take positive action immediately to prevent a midair collision.

1. **Straight-ahead Rejoin.** Use straight-ahead rejoins when a turn is not possible or practical. Airspeed closure is used to effect a straight-ahead rejoin. Number 1 should maintain a stable platform (level, climbing or descending), clear the area and monitor Number 2 during the rejoin. Clearing for the formation takes priority over monitoring Number 2; however, both should be accomplished, time permitting.

    a. **Number 1.** Direct the rejoin. If a turn is required during the rejoin after a straight-ahead rejoin is initiated, inform Number 2 and clear the area. Do not turn into Number 2 if it will exceed Number 2's capabilities or prevent a safe rejoin. Due to the location of Number 2 behind and below Number 1, Number 2 will be difficult to see until the final stages of a straight-ahead rejoin.

    b. **Number 2.** Rejoin to the left side unless directed otherwise. Increase airspeed to generate closure (initially use 20 to 30 knots of overtake). Establish a position behind and slightly below Number 1 with a vector toward Number 1's low 6 o'clock position. Placing Number 1 slightly above the horizon will help maintain separation

from Number 1's wake turbulence. Continue to close until approximately 500 feet (when details on Number 1's aircraft, such as the pitot tubes can be seen). At this point, bank slightly away from Number 1 (make a bid) toward a position two to four ship widths out from Number 1's wingtip. The velocity vector should angle away from Number 1. Decrease overtake speed with a power reduction, and plan to arrive in the route position with the same airspeed as Number 1. As a technique, reduce the power such that the PCL moves aft to match Number 1's aft LOS in the windscreen. After stabilized in route, move into close (fingertip). If Number 1 turns during a straight-ahead rejoin, transition to a turning rejoin, and be alert for possible overshoot situations.

2. **Turning Rejoin.** Use a combination of airspeed and angular closure to affect a turning rejoin.

a. **Number 1.** Direct the rejoin. If using a wing rock, attempt to make the first wing dip in the direction of the rejoin. Maintain prebriefed airspeed and bank angle. After a pitchout, delay long enough for Number 2 to roll out in trail. Establish a turn, maintain bank angle, and rejoin airspeed in level flight. Bank and pitch may be varied if required for area orientation. A slight climb or descent is acceptable for energy management. Monitor Number 2's AA and closure. Be ready to take evasive action if required.

b. **Number 2.** Base closure and desired aspect on energy and aircraft position relative to Number 1. When Number 1 starts to turn, begin a turn in the same direction to intercept the desired AA. Simultaneously establish desired vertical separation (place Number 1 within approximately two to four ship widths of the horizon) and closure. Manage AA with minor adjustments to bank angle. Number 1 must be visible to pilots in both cockpits.

i. Use power as required to generate closure and a moderate lead pursuit picture (pull nose in front of Number 1) to increase AA. As Number 2 moves inside of Number 1's turn circle, the vertical stabilizer appears to move toward Number 1's outside wingtip as AA increases. When the vertical stabilizer bisects the outside wing (3 aspect/30 degrees AA), reduce bank angle to maintain this relative reference line. When stable, there is no LOS.

ii. If the vertical stabilizer appears to move toward the wingtip, AA is increasing. If the vertical stabilizer appears to move toward the wing root, AA is decreasing. Use varying degrees of bank angle to manage AA during a rejoin.

iii. Number 1 should appear slightly above the horizon. As a technique, maintain Number 1 within approximately one to three relative ship widths above the horizon.

iv. The critical stage of the rejoin begins approximately 500 feet from Number 1. Inside 300 to 500 feet, the normal close (fingertip) references will become visible. Move forward (increase AA with lead pursuit) slightly onto an extension of the close (fingertip) reference line. Begin decreasing closure with a power reduction and speed brake as necessary. Monitor bank and overtake closely during the last few hundred feet to ensure AA and closure are under control. Plan to stabilize in route with slight positive closure but approximately co-airspeed with Number 1, and then move into close (fingertip) at a controlled rate. To control closure, use the speed brake after the power has been reduced below 20% (light in the gear handle) but before idle power is selected. This results in less spool up time and builds good habit patterns for follow-on aircraft.

v. During two-ship formation operations (unless briefed or directed otherwise), Number 2 rejoins to the inside of the turn. However, Number 2 may request to rejoin on the outside of the turn.

AA and airspeed may be varied to account for different levels of proficiency and different situations. During turning rejoins, bank angle will be 30 or 45 degrees, or as briefed. Number 1 calls out actual airspeed if airspeed differs more than 10 KIAS from briefed or expected rejoin airspeed.

407. OVERSHOOT

Objective. Safely dissipate excessive closure and AA.

Description. A properly flown overshoot will safely dissipate excessive closure and AA during a rejoin. The Air Force overshoot is the same as the underrun procedure.

Procedure. Keep Number 1 in sight at all times during any overshoot.

1. **Straight-ahead Rejoin Overshoot.** A straight-ahead rejoin with excessive closure results in a pure airspeed overshoot. Maintain lateral spacing on a parallel or divergent vector to Number 1. Select idle and speed brake (if required) as soon as an excessive overtake is recognized. Do not turn into Number 1. This can cause a vector into Number 1's flight path and create a dangerous situation requiring a breakout. A small, controllable 3/9 line overshoot is easily managed and can still allow an effective rejoin. There is no need to breakout if flight paths are not convergent and visual contact can be maintained. After beginning to slide back into formation, retract the speed brake and increase power prior to achieving co-airspeed (no LOS) to prevent excessive aft movement.

2. **Turning Rejoin Overshoot.** A turning rejoin with excessive closure airspeed results in a combination airspeed-aspect overshoot in a POM about 50 feet below Number 1. Decide to overshoot early enough to cross Number 1's 6 o'clock with a minimum spacing of two ship lengths. Breakout if unable to maintain nose-tail separation. Select idle and speed brake (as required). Outside the turn, use bank and back stick pressure as necessary to stabilize in route

echelon position. Fly no higher than route echelon. Excessive back pressure causes closure. A co-airspeed overshoot due to excess AA may not require maneuvering outside of Number 1's turn circle. Instead, there may be sufficient space in Number 1's low 6 o'clock to align fuselages and stop the overshoot. When under control, return to the inside of Number 1's turn, reestablish an appropriate rejoin line, and complete the rejoin. During a turning rejoin overshoot, the magnitude of excess overtake determines the distance Number 2 must fly outside Number 1's turn circle to arrest the excess energy.

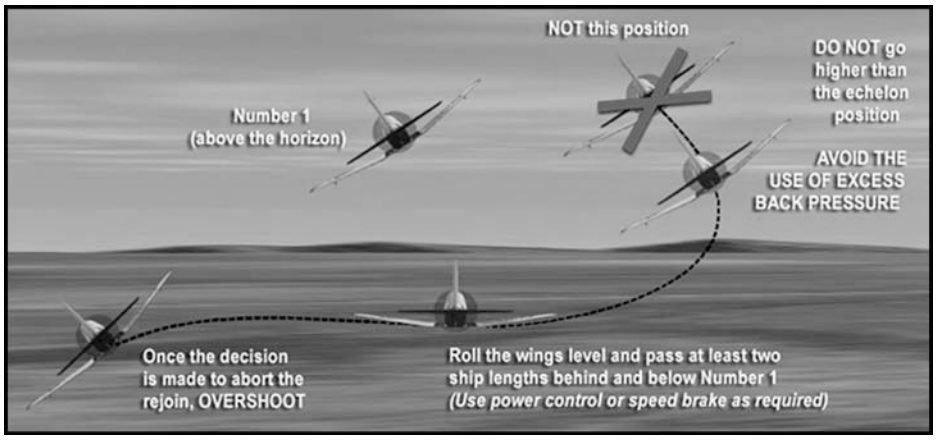

Figure 4-4 Overshoot

408. FIGHTING WING POSITION

Objective. Enhance formation flexibility or maximize clearing.

Description. Fighting wing is a fluid position defined by a 30 to 45 degree cone, 500 to 1,000 feet aft of Number 1. Fighting wing position is flown during the Extended Trail (ET) exercise.

Procedure. Number 1 directs the wingman to fighting wing with a radio call, *"Texan 2, go fighting wing."* Number 2 acknowledges and maneuvers into the cone. Do not call "in" unless performing the ET exercise.

1. Number 2 maneuvers into and maintains the cone with a combination of pursuit curves and lift vector placement. An initial turn away from Number 1 (lag pursuit) increases lateral spacing and causes a slight movement aft of Number 1 (forward LOS). The rate of aft movement can be increased with use of power, speed brake, or a vertical move out-of-plane. It requires constant analysis of AA and closure to apply the proper amounts of lead and lag pursuit to stay within the cone. Number 2 should not stagnate in Number 1's 6 o'clock because it is difficult for Number 1 to monitor Number 2 in this position.

2. **Reform from fighting wing**. Number 2 should reform to the same original side unless briefed or directed otherwise.

Visually, the aft limit of the cone is the same as for the basic rejoin: Number 1's vertical stabilizer bisects the opposite wing. The forward edge of the cone is the approximate position when Number 1's vertical stabilizer is superimposed over the opposite wingtip or when the inside wingtip strobe light is just forward of the spinner.

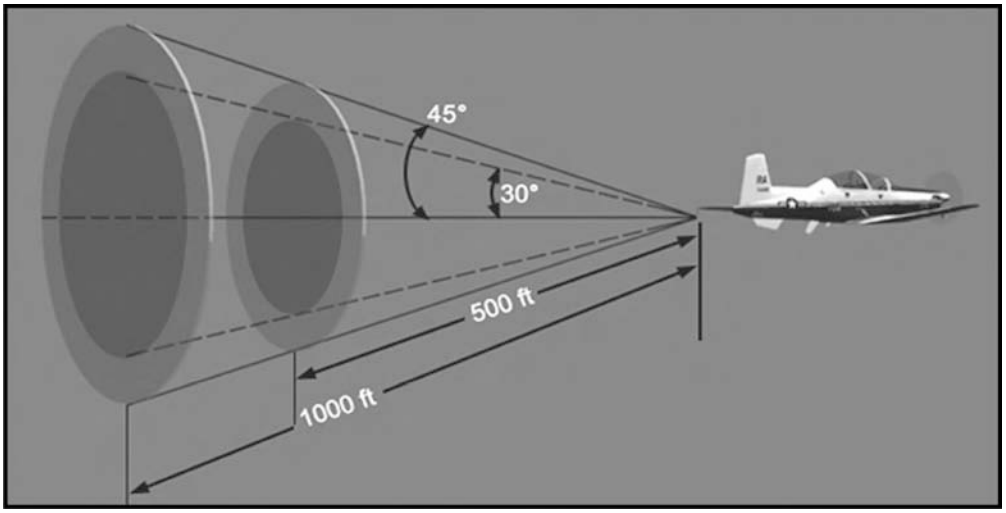

Figure 4-5 Fighting Wing Cone

409. CHASE

Chase ships can be a tremendous asset during emergency situations. They can lead aircraft with instrument malfunctions through weather, provide assistance, or handle communications with ATC.

It is important when flying chase to be able to back up the emergency aircraft. Have the Pocket Checklist (PCL) out to the appropriate section in case the emergency aircraft needs you to read the checklist. Do not fly so close as to get in the way, but also not so far away that you are providing little visual support. Clear for the formation, as the emergency crew will likely be heads down. ***Safety chase observers will maneuver in a 30 to 60 degree aspect cone out to 1,000 feet.*** The chase pilot is primarily responsible for aircraft separation. Avoid flying in close unless cleared by the emergency aircraft for an airborne inspection.

Midair Collision. If a midair collision occurs between formation members, they will not act as chase ships for each other.

Ejection. If one aircraft in a formation must perform a controlled ejection, the chase ship should fly abreast of the disabled aircraft and no closer than 1,000 feet.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER FIVE
GROUND OPERATIONS

500. INTRODUCTION

Engine Start

Formations normally start engines on a visual signal, either pilot-to-pilot or relayed through the crew chiefs. If aircraft are parked beyond visual range, the FL can set a start time. If starting without visual contact between pilots or crew chiefs, Number 1 will normally check Number 2 in on the radio at check-in time. Consult local unit standards for appropriate procedures. Number 2 will inform Number 1 of any difficulties that may delay start or taxi as soon as possible.

501. BEFORE TAXI

All flight members will check the ATIS before check-in. When ready to taxi, Number 2 gives a thumbs-up signal to Number 1. If not in visual contact, Number 2 awaits check-in.

Number 1 normally checks the flight in on VHF, then UHF. If more time is needed, notify Number 1 on the post start check-in. For example:

"Texan check victor", "2 needs 5 minutes for ground checks"

"Texan check uniform", "2"

After check-in, Number 1 calls for departure clearance. After Number 1's clearance acknowledgement, Number 2 responds with *"2"*, indicating that the clearance is understood. If Number 2 does not understand the clearance, ask for clarification.

502. TAXI

The formation normally taxis together as a two ship. If another aircraft attempts to taxi between members of the formation, Number 1 asks that aircraft to hold. Formations may taxi staggered when taxiway width and local procedures allow. Number 1 should stagger on the downwind side.

503. BEFORE TAKEOFF

When complete with the Before Takeoff Checklist, Number 2 gives a thumbs-up signal to Number 1. Number 2 shall ensure he sets his TCAS and transponder to STBY prior to takeoff.

504. AFTER LANDING

After landing, the formation exits the runway, checks in on ground, and then taxis back as a formation. If the flight was split, either on recovery or in the VFR pattern, flight members will taxi back single ship.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER SIX
DEPARTURE

600. INTRODUCTION

Objective

Environmental and training requirements determine takeoff method. Number 1 will ensure all members of the formation understand the takeoff option being executed.

601. RUNWAY LINEUP

Once cleared onto the runway, the formation will complete their Line-up Checklists individually and maneuver to the center of their respective sides of the runway. Number 1 will position himself on the downwind side of the runway. If winds are calm or straight down the runway, position Number 2 on either side. Line up in close/fingertip position with 20 foot minimum wingtip spacing.

602. FORMATION TAKEOFF

Objective. Safely launch the formation.

Description. There are two methods for launching a T-6B formation. One, the "wing takeoff," also known as the section takeoff. Two, the interval takeoff.

Procedures. Perform IAW the T-6B Primary Formation FTI. However, USAF visual signals are slightly different and will be conducted IAW Appendix B of this FTI.

603. FORMATION DEPARTURES

It is common for formations to depart on an IFR clearance, whether IMC or VMC. Standard Instrument Departures will be flown as published when applicable. It is imperative that Number 1 flies a stable platform as well as adheres to all altitude and heading directions.

In the Air Force Advanced Formation stage, students will get exposure to these departures through simulated SIDs out of Whiting and actual SIDs off station. Moving a formation as takes more time and work, so plan accordingly.

604. CLIMB/LEVEL OFF

Upon leveling off, complete all checks and stay ahead of the aircraft. Consider using enroute time to accomplish training. If situation permits, execute tactical turns, practice lost wingman, etc. If planned appropriately, training can be maximized. Use a formation position that best suits your formation. Put the wingman to route, wedge, LAB, or any other briefed formation position to maximize visual lookout and mutual support.

605. ABNORMAL PROCEDURES

Ultimately, each crew must deal with abnormal procedures within his or her own cockpit. Other formation members can either complicate situations or provide valuable mutual support. The key to dealing with abnormal situations is to maximize the positive aspects of formation without letting the distractions hinder successful recovery.

1. **Formation Takeoff Abnormalities:**

   a. **Number 2 Passing Number 1.** It may be difficult for Number 2 to determine if Number 1 is experiencing a problem (loss of power, etc.) that requires an abort. If Number 2 overruns Number 1, Number 2 selects maximum power and executes a separate takeoff while maintaining the same side of the runway. Follow Number 1's directions.

   b. **Number 2 Falling Behind Number 1.** If Number 2 falls behind on takeoff, Number 2 may not have sufficient airspeed to rotate with Number 1. In this case, Number 2 cross-checks engine instruments and the airspeed indicator, and aborts (if there is a problem) or performs a separate takeoff. For a separate takeoff, Number 2 rejoins after becoming safely airborne.

2. **Formation Takeoff Abort (One Aircraft).** If an abort becomes necessary, maintain aircraft control, ensure separation from the other aircraft (maintain the respective side of the runway), and make a radio call as soon as practical, *"Texan 2 is aborting."* Do not sacrifice aircraft control to make a radio call. During an abort situation, the aircraft continuing the takeoff maintains its side of the runway and executes a normal single-ship takeoff.

3. **Interval Takeoff Abort.** If Number 1 aborts, make a radio call when practical. It may be difficult for Number 2 to recognize an abort using only visual cues. If Number 2 has not released brakes, Number 2 reduces power and holds position until Number 1 clears the runway. If Number 2 is rolling, an abort or continued takeoff should be considered based on spacing and groundspeed.

4. **Element Abort.** During a formation takeoff, there are normally no sympathetic aborts after brake release. Sympathetic aborts can create situations in which the good aircraft risks making the situation worse by adding another aircraft into the high-speed abort situation. If an element abort is necessary (both aircraft abort), each aircraft must maintain its respective side of the runway and make every effort to stop prior to the end of runway. Number 1 directs an element abort with a radio call, *"Texan 1, flight abort, abort, abort."* The operative word, "flight," indicates both aircraft should abort.

CHAPTER SEVEN
MISSION EXECUTION

700. INTRODUCTION

This section describes formation mission execution and advanced formation maneuvering. The basics of departure, en route, area, and recovery procedures are the same as for single-ship missions; however, accommodations must be made for the additional aircraft in a formation.

701. AREA ORIENTATION/MILITARY OPERATING AREA (MOA)

Visual ground references such as cities, lakes, road intersections, terrain, etc., are the primary means of maintaining area orientation. To augment visual orientation, the FMS and VOR/DME should be used. A good composite cross-check of ground references verified by instruments is an effective way to maintain Situational Awareness (SA).

Air Force Advanced Formation sorties will be flown in a MOA to the maximum extent possible. If unable, caution should be used while conducting dynamic maneuvering and flight following should be utilized when available.

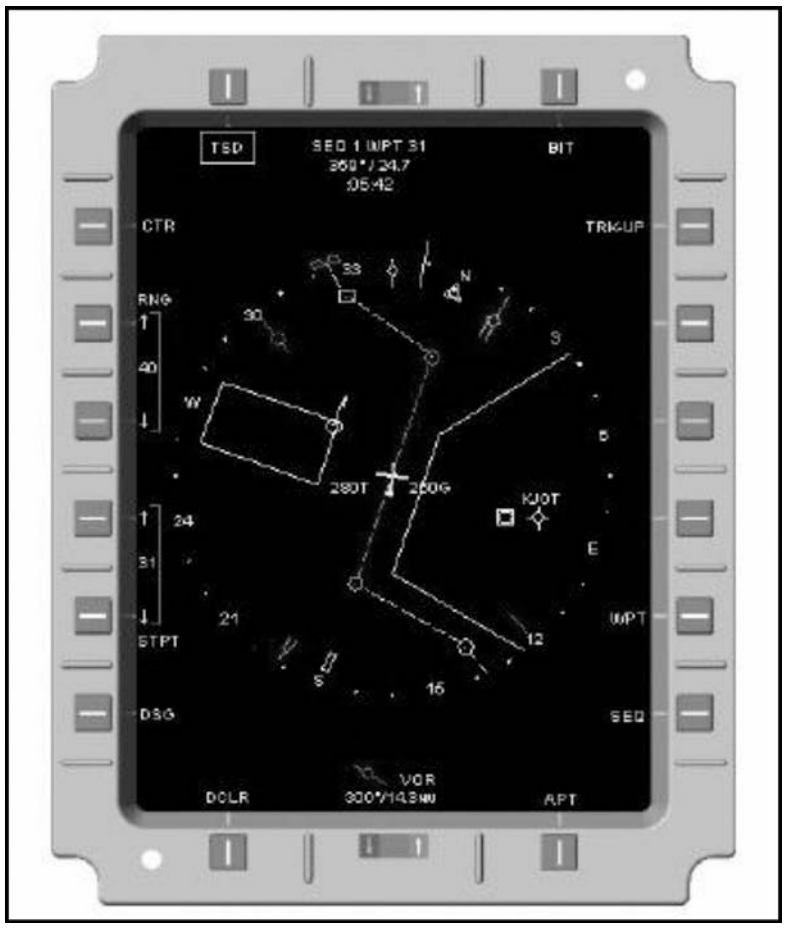

Figure 7-1 Area Management

1. **VOR/DME.** Area boundaries are sometimes defined with VOR radial and DME. There are two primary methods that utilize VOR/DME for area orientation.

   a. **Center Radial (Course) Method.** Set the center radial or center course of the area in the FMS. When center radial is set, the course arrow points away from the NAVAID; when center course is set, the course arrow points toward the NAVAID. The center of the area (laterally) is always toward the course deviation indicator (CDI). This method is best suited for areas that are 20 radials wide or less.

   b. **Pie-in-the-sky Method.** Best used in wide areas (20 radials wide or more). Set one boundary (course) in the CDI and mark the other boundary (course) with the heading bug. Keep the head of the bearing pointer, which always falls, between the head of the course arrow and the heading marker.

2. **FMS Map.** Select a range in the FMS map mode so that the working area almost completely fills the display. A larger range may be useful to show adjacent areas and other waypoints of interest. It is common to set the center radial or pie-in-the-sky in the Primary Flight Display (PFD) as a backup.

702. AREA PROFILE

It is lead's responsibility to make sure all required training is accomplished. The more expeditious the execution, the more training that can be accomplished. Sortie profiles will need to be adjusted based on time, fuel, and training requirements.

In order to ensure all training is completed, maneuvers must smoothly flow from one to another. There should be minimum "droning" time between maneuvers. Study parameters for each event and try to tie them together in a logical sequence.

An example of an efficient area profile might include: Formation G-Exercise, Practice Lost Wingman Exercise, Wing work, Breakout Exercise, Extended Trail Exercise, Tactical Maneuvering, RTB/USAF pattern operations.

Students should plan each profile for required training. Flight leads/IPs will ensure effective training is accomplished IAW the MCG.

703. ENERGY MANAGEMENT

Efficient energy management allows the sortie profile to be accomplished with minimum wasted time and fuel. Energy state is defined by airspeed (kinetic energy) and altitude (potential energy) and is manipulated with power, drag, and G loading. Plan maneuvers in a sequence that minimizes the requirement for deliberate energy changes, and makes use of the inherent energy gaining or losing properties of individual maneuvers.

Altitude and Airspeed Exchange. Potential energy (altitude) and kinetic energy (airspeed) can be traded. For example, 1,000 feet of altitude equals approximately 50 knots of airspeed with the canopy bow on the horizon and power at maximum. Options include:

Altitude for airspeed - maximum power with the canopy bow on the horizon.

Airspeed for altitude - maximum power, wings level, and 20 degrees nose high.

Optimum Energy State. In a typical MOA, optimum energy for aerobatic maneuvering is 180-200 KIAS at an altitude midway between the top and bottom area limits. Energy is sufficient for any aerobatic maneuver after an airspeed or altitude exchange to meet briefed entry parameters. This option may not be optimum if the airspace is limited by weather, ATC restrictions, or other limiting factors.

704. FORMATION G-EXERCISE

The G-Exercise is similar to the G-Awareness from basic formation training except the turns will be 180 degrees and executed from a pitchout or tactical LAB. Accomplish a G-awareness exercise on sorties that include maneuvers that require 3 or more Gs.

The G-awareness exercise should be a level or slightly descending turn, using maximum power. Begin the maneuver with sufficient airspeed to sustain 4 Gs. For planning purposes, use approximately 200-220 KIAS minimum for a level to slightly descending turn where the nose remains within 10 degrees of the horizon. The G-onset rate should be slow and smooth, allowing sufficient time to evaluate the effectiveness of the AGSM and determine G tolerance. Increase Gs to approximately 4 Gs in order to allow for full cardiovascular response.

For advanced aerobatic and formation training, the G-awareness exercise should be flown to G loads of 4-5 Gs.

If gray out begins during the demonstration, return to 1 G flight, reevaluate the strain, and then smoothly reenter the G-awareness exercise. If personal G tolerance is lower than required for the sortie, terminate high-G maneuvering.

1. **Pitchout**. The G-Exercise from the pitchout will consist of two 180 degree turns. The first turn (pitchout) will be flown at 4 Gs, 200-210 KIAS. After rejoining, the second turn (pitchout) will be flown at 5 Gs, 210-220 KIAS. Reference Chapter 4, pitchout procedures.

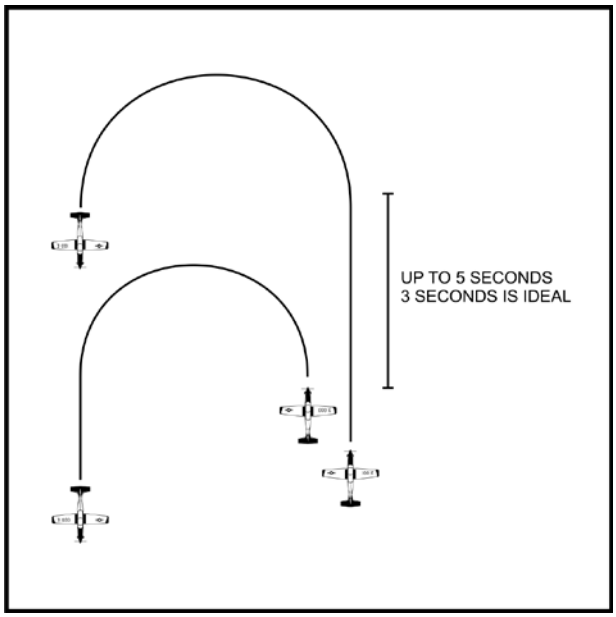

Figure 7-2 Pitchout

2. **Tactical LAB**. The G-Exercise from LAB will consist of two 180 degrees turns. Minimum 3000' separation is required. The first hook turn will be flown at 4 Gs, 200-210 KIAS. The second hook turn will be flown at 5 Gs, 210-220 KIAS. Reference Chapter 9, tactical LAB position and hook turns.

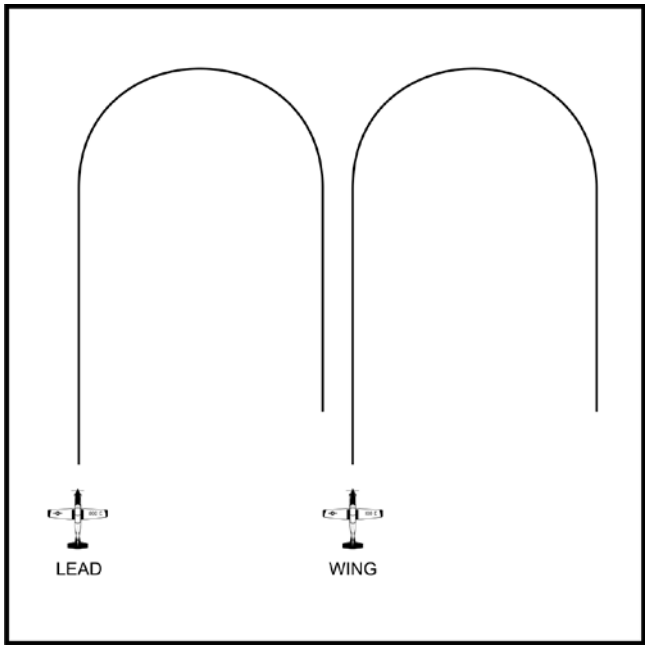

Figure 7-3 Tactical Line Abreast (TAC LAB) Hook Turn

7-4 MISSION EXECUTION

705. PRACTICE LOST WINGMAN EXERCISE

Objective. Safely separate aircraft when in close formation.

Description. Lost wingman procedures are practiced in VMC (only) to prepare for actual lost wingman situations in IMC.

Procedure. Number 1 directs practice lost wingman with a radio call, *"Texan 2, go practice lost wingman."* Number 2 acknowledges. Number 2 executes the appropriate lost wingman procedures and makes the appropriate radio call. At a minimum, Number 1 will respond with attitude and heading, to include bank angle. Number 1 will monitor Number 2 to ensure adequate separation. After executing the appropriate lost wingman procedure, Number 2 will call, *"Texan 2, visual."* Number 1 will then direct a rejoin. Reference Chapter 2.

706. WING WORK EXERCISE

Objectives:

1. **Number 1**. Develop judgment and skill necessary to lead a formation through varying flight regimes. Use a combination of smooth changes in pitch, bank, and wing loading (Gs) to provide a stable platform with consistent, predictable roll rates, and no sudden changes in back pressure. Clear visually while planning for the formation (navigation, next maneuver, etc.) and monitor Number 2. Clear, plan, and monitor.

2. **Number 2**. Maintain or constantly correct back to the proper close (fingertip) position. Develop proper power and stick control using small, smooth, deliberate inputs. Avoid tendency to focus or stare at any single reference. Practice visually scanning all of Number 1's aircraft for position references while visually clearing through Number 1.

Description. The Wing Work (WW) Exercise is typically flown as a series of maneuvers inside a targeted airspeed range. Build up to 2 to 3 Gs and approximately 90 degrees AOB as proficiency improves. A leaf of the WW Exercise is considered a vertical pull up with both an apex and bottom of a lazy-eight-type maneuver. A complete WW Exercise is considered a minimum of two leaves, one in each direction (a turn toward and a turn away) on each side of Number 1. Practicing the lower levels of the WW Exercise gives Number 2 a reduced pitch, bank, and G environment to recognize deviations and develop the ability to correct. This allows Number 2 to build the skills necessary to effectively and efficiently correct and maintain the proper close (fingertip) position.

Procedure. WW Exercise Levels provide a building-block approach to develop close (fingertip) flying skills and proficiency. Levels also provide a way to set training objectives.

1. **Number 1**:

    a. **Power Control and Energy**. Target energy state is the middle of the area altitude block between approximately 180 to 200 KIAS. Normally, Number 1 sets power to

maintain desired energy state. Use approximately 50 to 55% torque in a low area (6,000 to 12,000 feet MSL) and approximately 55 to 60% torque in a high area (12,000 to 18,000 feet MSL). Avoid extremely low or high power settings during the WW Exercise as it limits the ability of Number 2 to adjust for deviations.

b. **Maneuvering**. During initial training, use smaller bank angles, and conservative climbs and descents, to stay within Number 2's capabilities. Avoid advancing to higher levels too quickly. Initially blend pitch with roll to the desired bank angle. Hold the bank angle as the nose of the aircraft drops through the horizon. As the nose approaches the desired nose-low pitch attitude, begin the rollout and reverse direction while maintaining positive G. As a technique, trim set for a slower airspeed can help make a smooth vertical pull up. Attempt to pull through the horizon in a near wings level attitude. Use bank angle to aid pitch control. Do not stair step or ratchet roll rates into or out of turns. Initiate changes in bank smoothly, then continue using moderate, positive movements, and be predictable. Do not begin a rollout and suddenly roll back into the bank. If a turn must be continued for area orientation, stop the roll, pause momentarily to allow Number 2 to adjust, then begin the roll smoothly back into the turn.

For turns into Number 2, visually clear the flight path before commencing the turn. The WW Exercise may be started with either a blend of pull and roll into a climb or descent, depending on energy state. If starting from a low kinetic or high potential energy state, smoothly increase bank angle, and allow the nose of the aircraft to slice to the desired nose-low attitude, and then begin the WW Exercise with a vertical pull up as stated above.

Consider environmental conditions, such as sun angle and cloud layers, and plan formation maneuvering to avoid them. Do not stare at Number 2, but continually monitor Number 2's position and status. Use the mirrors if necessary, and communicate with the other crewmember when required to assist monitoring Number 2. Be ready to take evasive action and direct a breakout, if required.

2. **Number 2**:

a. **Power Control and Energy**. The ability to fly well in close formation is the result of recognizing, anticipating, and applying small corrections. Make continuous, small, and controlled corrections to stay in position. Always keep the aircraft trimmed and coordinated. Make small, precise power changes instead of using large power bursts.

b. **Maneuvering**. When a deviation is recognized, initially correct one reference at a time. Correct to the vertical position or stack first, then correct fore or aft to the close (fingertip) reference line. Finally, adjust the lateral spacing in or out.

c. **Turns Away**. When Number 1 turns away, Number 2's aircraft is in a lag pursuit position. If corrections are not made, AA and range increase. Number 2 must increase back pressure and climb to maintain vertical position. This requires an

increase in power to maintain airspeed and position. When Number 1 stops the roll-in, Number 2 must reduce power as the relative climb is complete.

d. **Turns Into**. Add slight forward pressure to maintain vertical position and reduce power. The collision potential increases in turbulent conditions or while flying maximum performance maneuvers.

e. **Pushover Maneuvers**. The ability to counteract movement toward Number 1 is limited near the zero or in negative G environment. For example, bank alone in zero-G conditions does not produce a heading change. Under these conditions, avoid wingtip vortices because a rapid roll into Number 1 may develop. Should a breakout become necessary, use flight controls, power, and speed brake as needed to ensure flight path deconfliction

707. FORMATION BREAKOUT EXERCISE

Objective. Practice breakout procedures in a controlled environment.

Description. Practice breakouts will be executed in VMC only and will be directed by the Number 1. During an actual breakout, either aircraft may initiate breakout procedures.

Procedure. With Number 2 in sight, Number 1 initiates the practice breakout with a radio call, *"Texan 2 break out."* Number 2 acknowledges, *"Texan 2 is breaking out."* Number 2 executes the appropriate breakout maneuver, and after separation is established, makes a radio call, *"Texan 2 is breaking out."* At this point, all maneuvering and radio calls are identical to an actual breakout. The priorities are: (1) ensure safe separation, (2) establish appropriate communications, and (3) get the formation back together.

If Number 2 appears to be obtaining excessive range, Number 1 may direct Number 2 to roll out with the radio call, *"Texan 2 roll out."* Number 2 will acknowledge the roll out and standby for further direction.

708. BLIND EXERCISE

Objective. Demonstrate deconfliction responsibilities.

Description. Emphasizes the correct lost sight procedures in the event one or both aircraft lose sight of each other. The exercise exposes IPs and students to a real lost sight situation in a scripted setup to practice the procedures, including verbal coordination required to facilitate safe separation and an expeditions rejoin. The ensuing possibility for a high aspect rejoin can effectively demonstrate lateral and vertical turning room requirements in relation to turn circle geometry, range, closure, AA, LOS, HCA, pursuit curves, and out-of-lane maneuvering.

Procedure:

Altitude - as required, ± 100 feet.

Airspeed - 180 ± 5 KIAS.

Heading - reference heading ± 5 degrees.

Power - 50% torque.

Setup the exercise from close (fingertip) or route formation. Before the exercise begins, Number 1 announces the exercise, *"Texan, standby blind exercise, reference (heading)."* Number 2 does not acknowledge. When ready to begin, Number 1 gives the execution command, *"Texan, turn away,"* and Number 2 acknowledges *"2."* Both aircraft then turn away from each other to a heading 90 degrees from the reference heading. Number 2 calls blind with his or her altitude after established 90 degrees off the reference heading, *"Texan 2, blind X feet."* The immediate concern must be to establish altitude separation between the aircraft. When Number 1 is also blind, Number 1 calls blind and immediately establishes altitude separation for each aircraft, *"Texan 1, blind Y feet, Texan 2 maintain X feet."*

1. Immediately following the second blind call, Number 1 must assign each aircraft a specific altitude with 1,000 feet (minimum 500 feet) vertical separation. Once altitude deconfliction is established and acknowledged, the potential for collision within the formation has been effectively eliminated as long as both aircraft remain at their assigned altitude. Only after altitude assignments are established and acknowledged will Number 1 begin coordination to rendezvous the flight and rejoin. Number 2 must inform Number 1 if unable to expeditiously reach and maintain the assigned altitude.

2. Once a vertical buffer is established, Number 1 may begin to coordinate for a rejoin by establishing common headings and a rendezvous point according to the preflight brief. The key to expeditious visual acquisition in a blind situation is effective communication from both aircraft within the formation. Number 1 is responsible for coordinating the rejoin. Whoever regains visual first should talk the other pilot's eyes on target by using relative clock position (bearing) from the other aircraft, elevation (in degrees) and range. For example, *"Texan 2, visual is at your 10 o'clock, 20 high, 2 miles."* If Number 2 is visual but Number 1 is still blind, Number 2 may provide recommended actions to facilitate visual between both aircraft. For example, *"Texan 1, recommend reference 090 heading, visual will be at your right 3 o'clock, slightly low, 3,000 feet").* The FL must ensure the preflight brief includes a thorough discussion of visual cues and ways to accomplish a high aspect rejoin.

709. EXTENDED TRAIL EXERCISE

Objectives. Extended Trail (ET) is divided into three distinct Levels.

Number 1. Provide a stable platform with consistent, predictable roll rates and no sudden changes in back stick pressure.

Number 2. Maneuver within the fighting wing cone through proper pursuit curve and lift vector application with a fixed power setting.

Description. ET is flown from the fighting wing position. The process of analyzing and solving angular, range, closure, and LOS problems requires an understanding of the consequences of lift vector placement and flying each pursuit curve.

Procedure. Both aircraft initially set and maintain the same power setting. As a guide, use 85% torque (up to 95% if needed) in a low area, maximum power in a high area.

The Bubble. A spherical safety airspace buffer surrounding each aircraft. The 300 foot bubble is a safety of flight limit that surrounds each aircraft. If an aircraft is inside the 300 foot bubble during ET, call "knock-it-off."

i. The ET maneuver limit is a 500 foot slant range. Momentary deviations within 500 feet are acceptable if quickly recognized and corrected. If unable to quickly regain the fighting wing cone, call "terminate."

ii. Abrupt turn reversals by lead are prohibited. Abrupt turn reversals are turns in one direction followed by a rapid, unanticipated roll in the opposite direction.

iii. ET is flown two-ship only.

iv. Do not maneuver over-the-top if Number 1 is blind or Number 2 is not in a position to go over-the-top.

v. Minimum airspeed for over-the-top is 100 KIAS. High power settings (greater than 60% torque), combined with high AOA (stick shaker), and slow airspeed (less than approximately 40 KIAS), can result in an unintentional torque roll. If airspeed, G, and AOA are not sufficient to continue the maneuver, terminate or knock-it-off as appropriate.

ITEM	A Range	B Other aircraft is:	C Other
1	300 feet	Width of AOA indexer turned sideways. 	Detail visible (canopy details, pilots). Tail flash easily readable (letters more clear than numbers).
2	500 feet	2/3 width of AOA indexer turned sideways. Aircraft size approximates four times the size of the wingtip anticollision strobe flash guard.	Normal fingertip references apparent. Canopy detail discernable. Letters on tail are discernable (numbers barely discernable).
3	1,000 feet	Approximately twice the size of the wingtip anticollision strobe flash guard.	Tail flash not visible.

Figure 7-4 Range Estimation

ET Entry. At an appropriate energy state (180 to 200 KIAS and approximately the middle of the altitude block), Number 1 directs the ET with a radio call, *"Texan 2, go ET Level 1/2/3."* Number 2 responds with *"2."* Number 1 makes a moderate G turn away from Number 2 at maximum power. Number 2 maneuvers into the fighting wing cone and calls, *"Texan 2 in"* before Number begins maneuvering. Both aircraft set and maintain the briefed power setting throughout the exercise.

1. **ET Transition or Termination.** When the desired learning objectives are met, Number 1 may direct a transition to another level of maneuvering or terminate.

   a. If Number 2 wants Number 1 to discontinue maneuvering (for example, loss of spacing), notify Number 1 with a *"terminate"* call with the reason. If spacing was the issue, when Number 2 calls in, Number 1 may resume maneuvering or direct the formation as required.

   b. To end the exercise, Number 1 or Number 2 calls *"terminate."* Number 1 may reduce power when Number 2 is in sight or when Number 2 acknowledges the terminate call.

2. **Post-ET Check.** After each ET exercise, Number 1 conducts a fuel and G check using the radio. For example, Number 1 states, *"Texan 1 ops check, 1's 800, 4.0 Gs,"* and Number 2 responds, *"2 same"* (if within 50 pounds and .5 Gs) or *"2, 800, 5 Gs."* Report the maximum G reading on all G checks.

3. **Flying ET - General.** Each pilot is responsible for taking the necessary action to avoid a collision; however, it is Number 2's primary responsibility not to hit Number 1. Because of the dynamic nature of ET, the potential for collision is increased, and flying ET requires uncompromising flight discipline. Any pilot in either aircraft must call *"terminate"* or *"knock-it-off"* if warranted.

a. **Number 1:**

i. Number 1 is a training platform for Number 2. Continually monitor G loading, and keep in mind that Number 2 typically requires more G than Number 1 to maintain position. Generally, look for Number 2 behind the wing in the 4 to 5 O'clock or 7 to 8 O'clock position, and be more vigilant if Number 2 strays from the cone parameters. If necessary, terminate or transition to the next lower Level of ET until Number 2 can maintain the fighting wing cone. Monitor Number 2's aspect, range, closure, HCA, and LOS for the possibility of an inadvertent 3/9 line or bubble violation. Do not delay calling KIO if it is evident one of these situations is about to occur.

ii. Consider the skill level of Number 2. Never maneuver in an unpredictable or abrupt manner that may force Number 2 inside the bubble or forward of the 3/9 line.

b. **Number 2:**

Use varying degrees of lead pursuit to maintain the fighting wing cone during ET. Do not stagnate in Number 1's 6 o'clock. Closure, range, aspect, HCAs, and LOS rate changes can occur rapidly, so be prepared to maneuver accordingly. Pause momentarily to see how rapidly Number 1 is moving in the canopy (LOS/LOS rate), predict Number 1's flight path, and then maneuver by selecting the appropriate pursuit curve and proper lift vector placement. Use pure and lag pursuit judiciously to avoid high aspect, HCAs, and LOS rates. Normally, little time is spent in lag pursuit. Use terminate procedures to cease maneuvering if unable to maintain position.

ITEM	A	B	C	D	E
	Level	Maneuvers	Bank	G loading	Power Setting
1	I (initial proficiency)	Stable Turn	30 to 60 degrees	~2-Gs	50% (fixed)
2	II (limited proficiency)	Turns, Modified Lazy 8	~120 degrees maximum	Moderate	85% (low area); MAX (high area)
3	III (desired proficiency)	Modified Cuban Eight, Loop, Cloverleaf, Barrel Roll	As required	As required	85% (low area); MAX (high area)

Figure 7-5 ET Exercise Training Levels and Parameters

4. **Level One:**

   a. **Number 1.** Begin ET Level 1 with a radio call *"Texan, go ET, Level 1."* After Number 2 acknowledges the Level 1 call, enter a moderate G turn of approximately 2 Gs. Set power to maintain a 30 to 60 degree bank turn with approximately 45 to 50% torque.

   b. **Number 2.** Use the same power setting as Number 1. Maneuver within the fighting wing cone using the appropriate lift vector and pursuit curves. Notice how difficult it is to stabilize in any one position without the use of power.

5. **Level Two:**

   a. **Number 1.** Begin ET Level 2 with a radio call, *"Texan, go ET, Level 2."* After Number 2 acknowledges the Level 2 call, select maximum power, and turn away from Number 2. For low and medium altitudes, 85% torque is a good power setting to maintain energy. Higher altitudes and air temperatures or a low initial energy state may require the use of maximum power. Maneuvering consists of modified Lazy Eights, similar to cruise maneuvering from the formation block. Do not exceed 120 degrees AOB or fly slower than 100 KIAS. Once the desired learning objectives have been met, transition to Level 3 or terminate the maneuver.

   b. **Number 2.** During maneuvers, predict Number 1's flight path and maneuver in relation to it. This requires constant analysis of Number 1's POM as well as relative aspect, range, closure, HCA, and LOS. Realize that pursuit curves exist in both the vertical and horizontal planes.

      i. Sometimes, exaggerated pursuit curve adjustments are required to stay in position. Normally, these type of corrections are only required for a short period of time. Sometimes a move toward lag pursuit may be the best option, but most of the time, using less lead pursuit is the answer.

ii. Intentional lag rolls are generally not required to maintain the cone. Transitory periods in Number 1's high or low 6 O'clock position are acceptable; however, avoid stagnating in the 5 to 7 O'clock position. Attempt to maintain the 30 to 45 degree cone away from Number 1's high or low 6 o'clock position.

6. **Level Three:**

a. **Number 1.** Begin ET Level 3 with a radio call, *"Texan, go ET, Level 3."* After Number 2 acknowledges the Level 3 call, select maximum power, and turn away from Number 2. Maneuvers are not flown as precise as the contage stage. Attitudes and airspeeds vary for effective training, area orientation, visual lookout, and smoothness. Challenge Number 2 with hard turns, modified lazy eights, barrel rolls, and over-the-top maneuvers. Teamwork is the key. Number 1 is not trying to force Number 2 into an overshoot. When needed, maneuver so Number 2 can get back into position and always ensure adequate airspeed is available for over-the-top maneuvers.

b. **Number 2:** Energy conservation becomes more critical at higher G and vertical maneuvering. High AOA, buffet, and stick shaker indicate that the aircraft is losing energy. When encountering these cues, prioritize between nose track and energy (airspeed). If nose track is a priority, sacrifice airspeed by pulling enough back stick pressure to facilitate continued nose track. This may place the aircraft in a negative energy state. Realize that sacrificing airspeed for nose track may eventually result in excessive spacing due to airspeed differential. If Number 1 is in a hard turn, relaxing back stick pressure may preserve energy or increase airspeed but can result in excessive spacing. Conservation of energy is critical during Level 3 of the ET exercise. The key is to maneuver in relation to Number 1, and balance the need for nose track and energy through proper pursuit curves and lift vector placement.

The addition of over-the-top maneuvering makes Level 3 the most challenging. If Number 1's nose position (longitudinal axis of the aircraft) is below the horizon, the aircraft is likely to be accelerating. One technique to minimize this effect is to "lag at the bottom, lead at the top." Lagging at the bottom means Number 2 should delay pulling up into the vertical until noticing LOS in the vertical. This will put Number 2's nose in lag to gain airspeed after Number 1 has already started tracking up in the vertical. At the apex of the maneuver, unless increased range is desired, sacrifice airspeed for nose track and attempt to beat Number 1's nose through the horizon (lead at the top). If range and plane are satisfactory, attempt to hit over-the-top with the nose through the horizon before or at the same time as Number 1, with fuselages aligned (zero HCA or angle off).

THIS PAGE INENTIONALLY LEFT BLANK

CHAPTER EIGHT
FORMATION RECOVERY

800. INTRODUCTION

This section describes visual and instrument formation recoveries as well as formation landings.

801. THE BREAK

Objective. Lead the formation to landing in a safe and efficient manner.

Description. Formation recoveries are similar to single-ship recoveries; however, operational restrictions such as weather minimums, runway condition, and winds can significantly change recovery options.

Procedure. Weather can complicate the recovery. In-flight checks may be difficult to perform in the weather (especially solo), and simple tasks such as changing radio frequencies can be challenging. Number 1 must consider Number 2's capabilities when developing the recovery plan.

1. **Split-up in the Area:**

    a. If single ship recovery is required, Number 1 verifies Number 2 has positional awareness, coordinates a new clearance for Number 2, and clears Number 2 off at the appropriate time.

    b. If weather is a factor, Number 1 should consider breaking up in the MOA or enroute IAW local procedures.

    c. Number 2 will not depart the formation until Number 1 has directed the formation to split up. Even if the controller gives vectors to Number 2, Number 2 is part of the formation and will not comply with air traffic controller directions until Number 1 splits the formation with a radio call, *"Texan 2, you are cleared off."*

2. **Descent to VFR Pattern:**

    a. In general, Number 1 should avoid low power settings (less than 20% torque). Instead of reducing power below 20% torque, the speed brake may be used.

    b. If weather allows, Number 1 can direct Number 2 to a position (route or fighting wing) that enhances clearing and allows greater maneuverability.

    c. Once established in the VFR pattern, all turns away from Number 2 are echelon unless briefed otherwise.

d. Prior to initial, Number 1 should position Number 2 on the side opposite the direction of the break. Number 1 should ensure initial is long enough to allow Number 2 to stabilize before the break.

e. At the break, Number 1 smoothly turns to the downwind and delays power reduction until the turn is initiated.

f. After Number 1's break, Number 2 waits a minimum of 5 seconds before turning. Attain spacing in the break and on downwind. On downwind, Number 2 should be slightly outside Number 1's ground track.

g. Number 2 flies a normal contact pattern. Perch points should be the same; however, Number 2 should not follow a poorly flown pattern. Go-around or breakout if required.

h. In crosswinds, Number 1 normally lands on the downwind side of the runway. If crosswinds are not a factor, Number 1 will land on the cold side of the runway (the side that both aircraft will turnoff of after the aircraft are slowed sufficiently). Number 2 will land on the hot side and clear cold when the aircraft has slowed sufficiently.

i. If splitting in the pattern after a formation low approach, the aircraft on the inside of the pattern pulls closed or turns crosswind first. If Number 2 is on the inside, Number 1 must visually clear in the turn direction, obtain clearance, and make a radio call clearing Number 2 to pull closed, *"Texan 2, you are cleared to pull closed."* Number 2 acknowledges.

802. FORMATION APPROACH & LANDING

1. Number 1 should position Number 2 on the upwind side of the landing runway.

2. Number 1 directs configuration with a radio call or visual signal. Use a radio call in IMC. The gear and flaps are normally lowered with only one signal unless briefed otherwise. Formation approaches are flown with TO flaps.

3. After internal confirmation, Number 2 checks Number 1's configuration and gives a thumbs-up signal. Number 1 checks Number 2 and returns a thumbs up if the configuration is correct.

4. Number 1 then transmits a gear down call to ATC for both aircraft. Maintain 110 KIAS on the approach unless winds dictate otherwise or a circling maneuver is required.

Wing Landing. When out of the weather with the runway in sight, Number 1 lines up on the center of one side of the runway and maneuvers to the touchdown zone approximately 1,000 feet down the runway.

Move to a Stacked Level position after breaking out and no later than one-half mile from the runway. Stacked Level vertical checkpoints: place the Number 1 pilot's helmet on the horizon. Lateral checkpoints: same references as the Section Takeoff . The increased lateral spacing increases the margin of safety if problems occur during touchdown or landing rollout.

Stacked Level on Final. Number 2 uses Number 1 as the primary reference during the flare and landing, but monitors the runway and flight parameters to ensure a safe landing.

1. Number 1 gradually reduces power during the round out. Number 2 must reduce power gradually to avoid falling out of position during the round out and flare.

2. On the runway, both aircraft maintain their side of the runway. Normal braking technique is used. If Number 2 passes Number 1 on rollout, do not attempt to maintain position by over braking.

3. If the furthest back aircraft is on the cold side, he or she will clear the aircraft in front to the cold side when separation is established and a safe taxi speed is established, *"Texan 1 cleared cold."* If the trailing aircraft is on the hot side, the aircrew clears themselves to cross.

Figure 8-1 Stacked Level on Final

803. FORMATION INSTRUMENT APPROACH

In the Air Force Advanced Formation stage, plan to fly a formation instrument approach on every sortie. The following are some commonly used memory aids:

Prior to commencing the terminal area descent from cruising altitude.

WHOLDS:

Weather, check prior to IAF or beginning in route descent.

Holding, coordinate holding instructions, if required.

Obtain clearance for the approach.

Let down plate (approach) review (see below).

Descent check.

Speed, slow down for holding, or low altitude procedure.

Prior to commencing final approach or between approaches.

DLIDS:

DME, hold as required.

Localizer, set correct frequency.

Inbound course, set if required.

Displays set.

Speed for approach.

804. LOW APPROACH/GO AROUND

Comply with any directed altitude restrictions if cleared for low approach only. Number 1 smoothly adds power to approximately 75% torque and follows normal missed approach procedures. If climbing back into IMC conditions, ensure Number 2 is in close before penetrating the clouds. If remaining VMC, push Number 2 to route after the initial climb is established.

805. FORMATION MISSED APPROACH

Smoothly advance power to approximately 75% torque and smoothly establish the missed approach climb attitude. Use the radio to direct the gear and flap retraction. Ensure the minimum climb gradient is maintained. Execute Missed Approach procedures as published or directed by ATC.

CHAPTER NINE
TWO SHIP TACTICAL FORMATION

900. INTRODUCTION

Tactical formation is designed to optimize weapons and radar employment while improving visual lookout and increasing maneuverability. Line abreast (LAB) is the most basic tactical formation and is most commonly referred to as "tactical."

901. RESPONSIBILITIES

The basic combat unit employed by fighter aircraft is the Element. The Element consists of two aircraft - the Element Lead and the Wingman. The Element Lead is referred to as Number 1, and the Wingman is referred to as Number 2. Some basic principles apply:

1. Number 1 is responsible for maneuvering the formation, and Number 2 is responsible for maintaining position. However, there are circumstances where these roles are reversed.

2. During turns of 90 degrees or more, it is understood that Number 2 will lose sight of Number 1 at some point in the turn. When this occurs, flight path deconfiliction roles reverse. Once Number 2 is visual with Number 1, Number 2 regains the primary responsibility for collision avoidance.

3. Number 2's primary reference for heading and airspeed is Number 1. Number 1 must crosscheck and monitor Number 2's position. Number 2 must back up Number 1 and be prepared to take the lead if necessary.

4. Both aircraft share equal responsibility with visual lookout. LAB provides excellent lookout capability.

5. Tactical formations are normally flown at airspeeds near cornering velocity, but other airspeeds may be flown as required. Unless otherwise briefed, the standard airspeed for T-6B tactical formation is 200 KIAS. A low MOA should be used whenever possible to maximize aircraft performance.

902. LINE ABREAST TACTICAL (LAB)

The parameters of T-6B tactical formation are defined as 2,000 to 3,000 feet lateral separation, LAB to 10 degrees aft, with a vertical stack of up to ±500 feet. Flying with a lateral separation of 2,000 to 2,500 feet in a low MOA and 2,500 to 3,000 feet in a high MOA with a vertical stack of 300 feet is optimal for the T-6B's performance and will most closely represent what pilots will see in follow-on training.

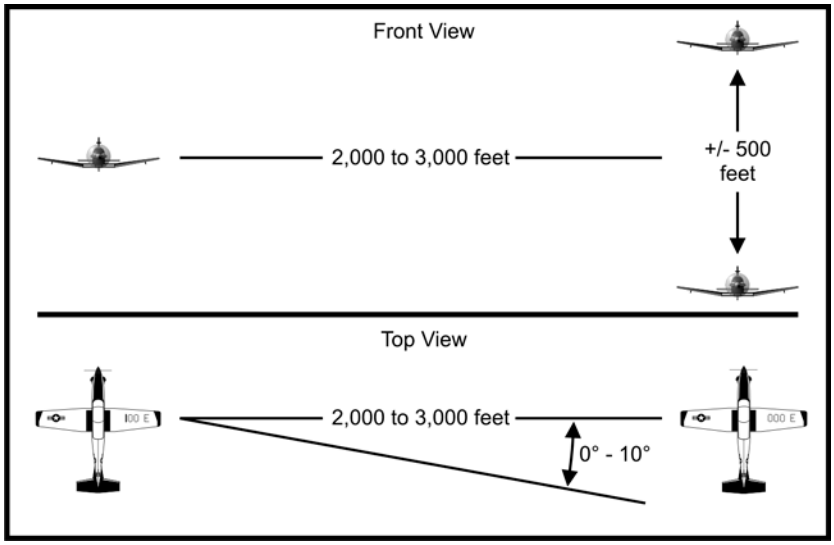

Figure 9-1 Line Tactical

1. **Number 1.** Send the formation to tactical by porpoising the aircraft or making a radio call, *"Texan 11, go tactical."* The porpoise signal should normally be given from the route position. LAB tactical requires Number 1 to maintain relatively strict formation parameters (heading and airspeed). Failure to do so will require Number 2 to devote excessive time to element integrity (maintaining position) at the expense of mutual support. Small heading changes should be minimized. Small course corrections may be accomplished through check turns. Turns of more than 30 degrees are usually accomplished by means of a delayed turn (45 degrees through 90 degrees). For reversing the flight path 180 degrees, a cross turn or hook turn can be used. Fluid turns are usually used at higher altitudes or heavy gross weight when hard turns are impractical.

2. **Number 2.** When sent to tactical, clear the area, and turn to a divergent heading while maintaining briefed tactical airspeed. When proper lateral spacing is achieved, check back into Number 1 with a small turn and align the fuselages. Always strive for LAB. If out of position, regain the proper fore and aft position, lateral spacing, and vertical stack in that order. Number 2's primary reference is Number 1, not the HSI! Although Number 1 calls for a 90 degree left turn, Number 1 is not required to turn exactly 90 degrees. Number 2 is responsible for staying in position.

Visual References and Corrections:

1. **Fore/Aft Position:**

   a. **Visual References.** The FCP visual reference for LAB is the wing leading edge of Number 1's aircraft (abeam position). Number 1 will appear slightly aft of the aileron trailing edge from the RCP. Visual references for 10 degrees aft from the FCP follow.

   b. **Number 1.** Number 2 over the aft wingtip navigation light.

9-2 TWO SHIP TACTICAL FORMATION

c. **Number 2.** Number 1's aft wingtip navigation light on center canopy bow or Number 1's helmet or wingtip cord lined up with the length of the forward canopy.

d. **Corrections.** Trade airspeed for altitude to ease back into position while maintaining energy. If behind, trade altitude for airspeed to regain LAB position. In either case, descend or climb slightly to match Number 1's airspeed and maintain position. Check turns may also be used to regain LAB.

2. **Lateral Spacing:**

a. **Visual References.** The FCP visual reference for 2,000 feet lateral separation is Number 1's aircraft slightly larger than the flash guard. The ejection seats and the pilot helmets are visible. At 2,500 feet from the FCP, Number 1's aircraft is slightly smaller than the flash guard and just the ejection seats are visible (can't see the helmets). At 3,000 feet from the FCP, Number 1's aircraft is about three-fourths the size of the flash guard. The canopy begins to blend in with the fuselage, and the prop blade is still visible. The RCP can use the static wick, which is the same size as the flash guard, for visual references.

b. **Corrections.** It is critical to ensure both aircraft are established on the same heading; small differences will quickly place the aircraft out of position. Check turns are used to make forward/aft corrections of LAB. Small turns into or away from Number 1 are used to correct lateral spacing. Increased power or vertical energy will also be required.

3. **Vertical Stack.** Use the altimeter to verify the vertical stack. Strive for ±200 to 300 feet, but no more than ±500 feet. Using a vertical stack greater than 500 feet will result in the RCP pilot losing sight of Number 1 under the wing. Ensure both pilots maintain visual.

903. TACTICAL TURNS

The Contract. All aircraft need to adhere to a "contract" to ensure turn radii are similar. Use the following parameters for contract turns: 200 KIAS, maximum power, G to hold airspeed (approximately 2 to 3 Gs), and a level turn. The second aircraft turning may vary altitude and Gs near the end of the turn in order to maintain formation position. At lower altitudes, pay attention to terrain elevation, descent rate, and bank angle.

Initiating the Turn. Radio calls or visual signals may be used to signal tactical turns. For example, the radio call for a delayed 90 degree turn would be, *"Texan 11, 90 left/right."* No radio response is required from Number 2. All tactical turns except a cross turn or hook turn into Number 2 may be signaled with a wing flash in the direction of the turn. Number 1 should show Number 2 the full plan form (approximately 90 degrees bank) when signaling a tactical turn to avoid confusion with minor course corrections (usually 30 degrees of bank or less). A "zipper" or rapid double-click of the microphone may be combined with the visual signal to get Number 2's attention.

Number 2 should interpret Number 1's visual signal as an invitation to start turning. After observing a wing flash from Number 1, Number 2 should immediately initiate a contract turn in the correct direction and watch for an additional signal. Once Number 2 loses sight of Number 1, it is assumed to be a delayed 90 degree turn. The same is true with a turn into the Number 2. When Number 1 is observed turning into the Element, Number 2 should be prepared for Number 1 to roll out. If Number 1 continues turning, then it is assumed to be a 90 degree turn.

Deconfliction. Number 2 will ensure separation by turning above Number 1's flight path whenever possible (the concept of "Number 2 always goes high").

Check Turn. The check turn is used for small heading corrections (usually no more than 30 degrees) or to realign the formation. Initiate the turn by transmitting, *"Texan 11, check* (number of degrees to turn) *left/right."* Number 2 does not acknowledge this call. Both aircraft turn simultaneously using a contract turn.

Delayed 90 degree Turns:

1. **Turns into Number 2:**

    a. **Number 1.** If the turn is called over the radio, Number 1 begins the contract turn immediately after the call. Otherwise, Number 1's contract turn into Number 2 signals the turn.

    b. **Number 2.** As Number 1 begins the turn, continue straight ahead and deconflict the turn. Initiate a 90 degree contract turn when you see Number 1's aircraft almost pointing at you (before you see a rapid increase of Number 1's LOS). If Number 1 disappears below the wing, start a turn 1 second after the aircraft disappears. When in a high MOA, start the turn when Number 1 reaches the aft wingtip light. If out of position, vary the timing and G loading of your turn, based on Number 1's LOS. Generally, when too close or too far aft, begin the turn earlier. When too wide or too far forward, begin the turn later.

2. **Turns Away from Number 2:**

    a. **Number 1.** Delay the turn as described above (turns into).

    b. **Number 2.** Begin a contract turn as soon as Number 1 signals for the turn (radio call or wing flash). Roll out after approximately 90 degrees of turn. When Number 1 rolls out, Number makes necessary adjustments to stay in position.

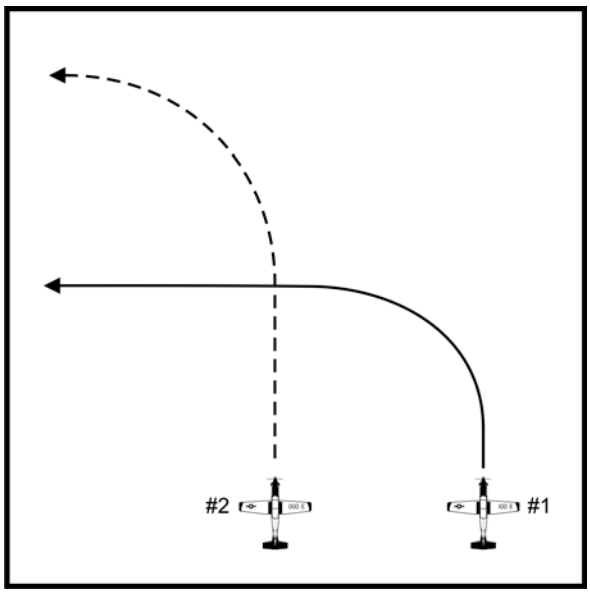

Figure 9-2 Delayed 90 Turn Into Number 2

3. **Turns Less Than 90 Degrees (Communication-out [Comm-out]).** Any time Number 1 initiates a comm-out turn, it is assumed to be a 90 degree turn. Number 1 will use the following procedures to indicate the turn is less than 90 degrees.

a. **Away from Number 2.** When Number 1 signals with a wing flash, Number 2 commences a contract turn into Number 1. Number 1 executes a large wing flash toward Number 2 when Number 2 reaches the desired rollout heading. Number 1 then maneuvers to attain LAB on the opposite side.

b. **Into Number 2.** Number 1 initiates a turn and rolls out on the desired heading. Number 2 maneuvers as required to achieve a tactical position on the other side of Number 1.

Delayed 45 degree Turns

1. **Turns into Number 2:**

a. **Number 1.** If the turn is called over the radio, Number 1 begins the turn immediately after the call. Otherwise, Number 1's turn into Number 2 signals the turn. During comm-out turns, Number 1 must ensure the rollout occurs before Number 2 begins the delayed 90 degree turn. If Number 2 begins a 90 degree turn, Number 1 should use the radio to communicate the desired turn.

b. **Number 2.** As Number 1 begins the turn, continue straight ahead and deconflict by obtaining vertical clearance. After Number 1 starts to turn, maneuver as required to attain LAB on the other side of Number 1's aircraft. One method is to continue straight ahead until Number 1 crosses your flight path, then maneuver to the opposite

side and roll out in position on the new heading. Another method is, just as Number 1 rolls out, execute an aggressive turn toward Number 1 while maintaining vertical separation and maneuvering airspeed. After crossing Number 1's flight path, reverse the turn and flow out to the correct tactical position on the side opposite from where the 45 turn started. Either method is acceptable; the latter is more expeditious.

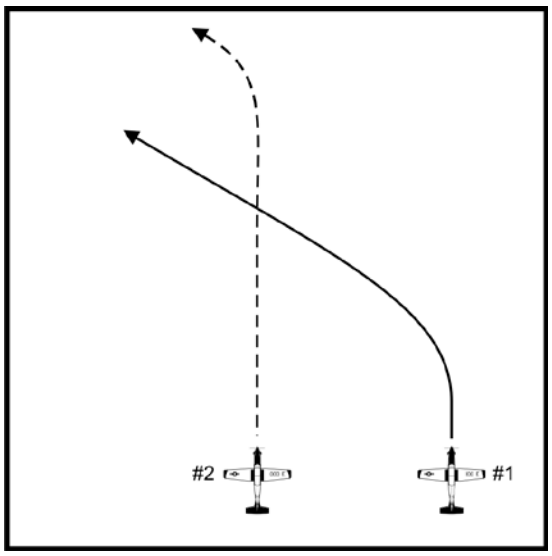

Figure 9-3 Delayed 45 degree turn into Number 2

2. **Turns Away from Number 2:**

   a. **Number 1.** Delay the turn as described above. Number 1 will maneuver to the opposite side of Number 2 in a LAB position.

   b. **Number 2.** When directed, begin a contract turn into Number 1. Number 1 signals Number 2's rollout by beginning a turn into Number 2. Number 2 rolls out, and Number 1 maneuvers as described. Once the formation is back to straight-and-level flight, Number 2 regains the responsibility for proper formation position.

In-Place Turns. Use an in-place turn when you want the formation to maneuver in one direction at the same time. To initiate, Number 1 transmits, *"Texan, in-place 90 left/right."* Number 2 does not acknowledge this call. Both aircraft turn at the same time, in the same direction, using contract turns. If executed from LAB tactical, a 90 degree turn will put the formation in trail at the same lateral spacing that existed prior to the turn. Another in-place 90 degree turn in either direction will return the formation to LAB.

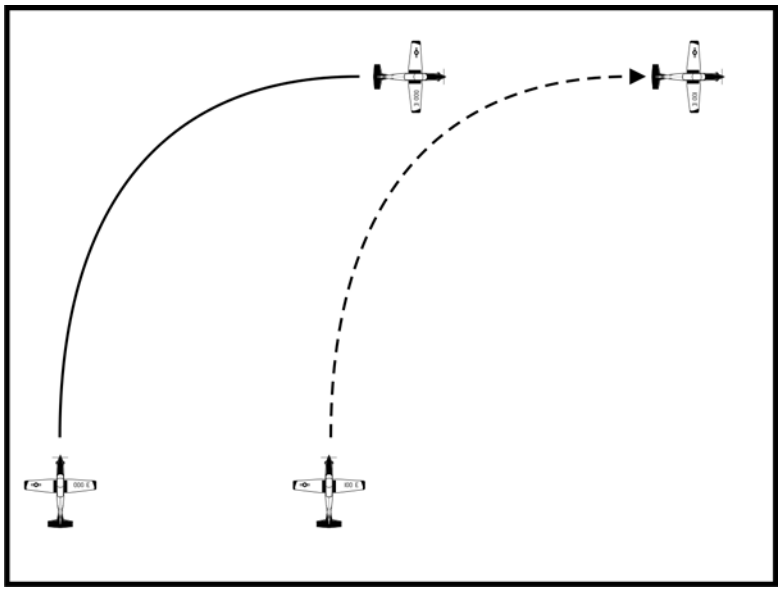

Figure 9-4 In-Place Turns

Hook Turns. During a hook turn, the formation turns 180 degrees with both aircraft performing a contract turn at the same time, in the same direction.

1. **Turns into Number 2.** A hook turn into Number 2 must be called over the radio, *"Texan 11, hook right/left."*

   a. **Number 1.** During the first half of the turn, Number 1 is responsible for maintaining visual and deconflicting flight paths. Match Number 2's fuselage through the first half of the turn. About halfway through the turn, Number 1 will lose sight of Number 2, and Number 2 will then pick up deconfliction duties.

   b. **Number 2.** Number 2 will be unable to maintain visual during the first half of the turn. After passing through 90 degrees of turn, begin looking for Number 1 while flying the contract. Once visual is attained, adjust the turn as needed to roll out in position after approximately 180 degrees of turn.

2. **Turns Away from Number 2.** Hook turns away from Number 2 may be signaled visually with a wing flash or called over the radio. If initiated with a wing flash, Number 1 will begin turning when Number 2 begins the turn. Number 1's immediate turn tells Number 2 this is a hook turn. For the first half of the turn, Number 2 should fly a contract turn while referencing Number 1. Number 2 should match Number 1's fuselage through 90 degrees of turn to maintain position. Use caution to avoid Number 1's jet wash. After halfway through the turn, Number 1 should acquire and maintain sight of Number 2. If flown properly, Number 2 will be in position at the rollout (exactly 180 degrees of turn). If not, Number 2 must maneuver to obtain the proper spacing and position.

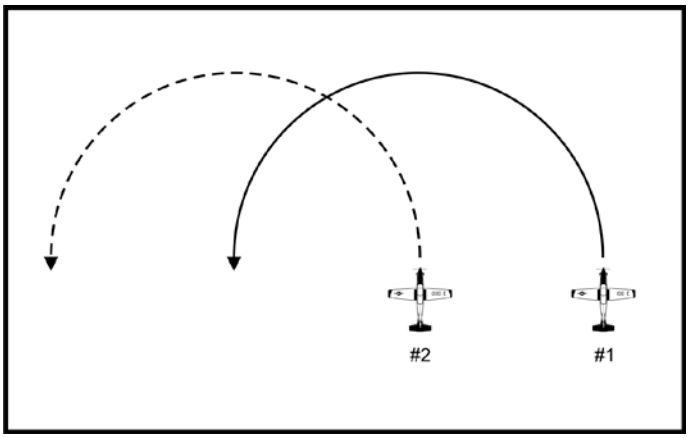

Figure 9-5 Hook turn into Number 2

Shackle. Use a shackle to place Number 2 on the opposite side or to allow Number 2 to regain the correct position. Initiate the shackle by transmitting, *"Texan 11, shackle."* Both aircraft simultaneously turn about 30 to 45 degrees into one another using a contract turn to attain about 60 to 90 degrees of HCA. Number 2 normally flies directly over or under Number 1 (maintain the current vertical stack). Both aircraft reverse the turn when crossing flight paths and roll out on the original heading.

When out of position at the start of the shackle, the formation can employ several methods to expeditiously regain position. If Number 2 is forward, Number 1 may elect to maintain the current heading. In this situation, Number 2 will aggressively bid toward Number 1 with approximately 90 degrees of HCA. Once across Number 1's flight path, Number 2 should reverse the turn and flow out into position on the opposite side from where the maneuver started. If aft, Number 2 may choose to continue straight ahead, and Number 1 can maneuver as described above.

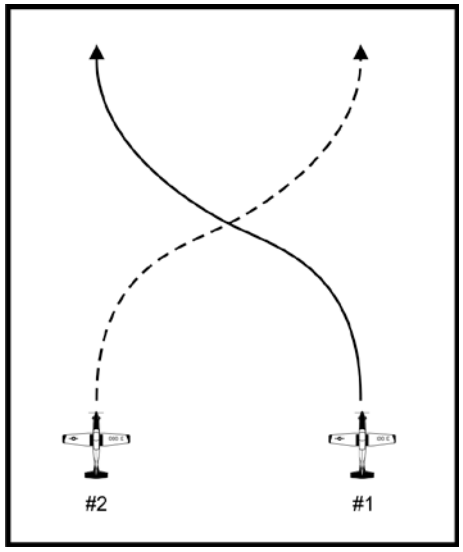

Figure 9-6 Shackle

9-8 TWO SHIP TACTICAL FORMATION

Cross Turn. Cross turns reverse the Element's direction by 180 degrees. Both aircraft make a contract turn into each other. Number 2 is responsible for maintaining altitude stack to ensure flight path deconfliction. Two problems arise during the turn. The first is the momentary loss of visual contact with the other aircraft. The second is that the turn performance may cause too much lateral spacing on rollout.

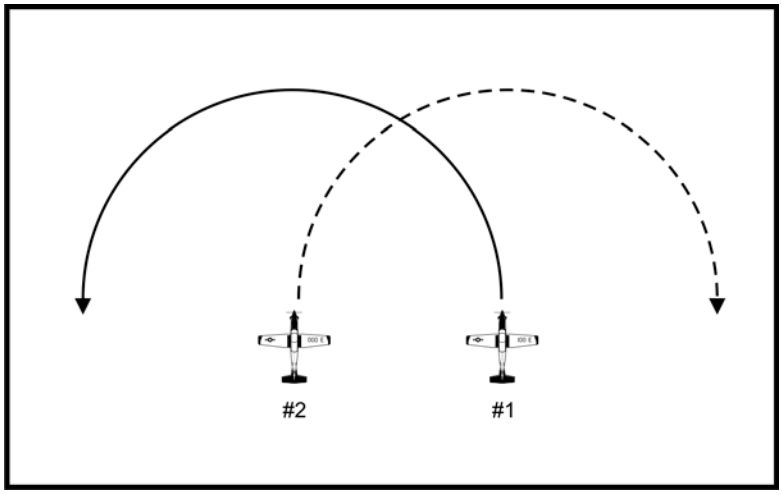

Figure 9-7 Cross Turn

Execution. Cross turns are executed on verbal command from Number 1, *"Texan 11, cross turn."* Both aircraft immediately commence a contract turn toward each other. Aircraft should cross after 60-90 degrees of turn and continue their turn through 180 degrees of turn. The flight is now on a reciprocal heading. Lateral separation may be wide even though the original spacing was correct. To correct this, perform a shackle.

Blind. If the other aircraft is not reacquired, call *"blind."* If Number 2 is blind, Number 1 will be directive, and may direct a shackle if visual with Number 2. In this case, it is Number 1's responsibility to maintain altitude deconfliction while attempting to talk Number 2's eyes onto Number 1. If Number 1 is blind, Number 2 will talk Number 1's eyes onto his aircraft while maintaining aircraft deconfliction responsibility. It is possible that neither aircraft will regain sight after the cross turn. In this case, both aircraft will maintain the reciprocal of the cross turn entry heading until directed otherwise by Number 1. Number 1 will ensure altitude deconfliction.

Fluid Turns. These turns are used to maneuver a formation when there is very little G or excess thrust available (heavy weight and/or higher altitudes). If a 180-degree turn is required, combine the techniques for two 90-degree turns. The radio call for a fluid turn is, *"Texan 11, fluid left/right."* No acknowledgement is required. Number 1 will begin turning immediately after the radio call.

1. **Contract.** Fluid turns are "geometry" turns with constant power settings. Number 1 will normally make heading changes in 90 degree increments using approximately 45 degrees of

bank while maintaining airspeed and altitude. If a 180 degree turn is required, execute two 90-degree turns.

2. **Turns into Number 2.** As Number 2, start a turn in the same direction as Number 1. One method is to use less bank angle than Number 1 and maintain it until crossing over and in front of Number 1. Another method is to initially match Number 1's bank and momentarily roll out of the turn or bank in the opposite direction to check Number 1's position. Depending upon Number 1's position at the start of the turn, you should normally have 20 to 30 degrees of the turn completed as Number 1 passes your 6 o'clock position. As Number 2, if you were behind when the turn started, you may want to delay the cross, or if ahead, cross earlier. Once you have crossed Number 1's flight path, increase bank and lower the nose to pick up airspeed, if needed. Control the turn to assume proper spacing. Use altitude to gain or reduce airspeed to arrive in the proper position as Number 1 rolls out of the turn.

3. **Turns Away from Number 2.** Number 2 is immediately behind at the onset of the turn. Number 2 should roll into more bank than Number 1 and lower the nose slightly to gain airspeed in order to move to the inside of the turn behind Number 1. As the turn progresses, Number 2 should reduce the bank to attain proper lateral spacing and trade excess airspeed for altitude as the aircraft approaches the LAB position. Airspeed corrections should be made by trading altitude for airspeed while maintaining a constant power setting.

904. TACTICAL REJOINS

Overview. Rejoins will be initiated with a wing rock or radio call. Number 2 will acknowledge all radio calls to rejoin. During tactical rejoins, Number 1 will fly 200 KIAS, 45 degrees of bank, and level flight. Different parameters (180 to 200 KIAS and 30-45 degrees of bank) may be briefed or called on the radio. Number 2 should strive to maintain closure during the rejoin.

Straight-ahead Tactical Rejoin. Number 2 will rejoin to the side occupied when the rejoin was directed. Unlike a normal straight-ahead rejoin from a trail position, a tactical straight-ahead rejoin begins from a lateral spread. The mechanics of flying this maneuver will vary based on your position when initiating the rejoin. If necessary, maneuver vertically or laterally to gain sufficient spacing (turning room). Decrease the AA with lag pursuit by turning 45 degrees (30 degrees in a high MOA) toward Number 1 to make a bid toward the 6 o'clock position. If forward LOS is not established by this initial heading change, it may be necessary to make another bid to Number 1's 6 o'clock. Keep the power up to accelerate to 20-30 knots of overtake. Be sure to eliminate the resulting angle off by aligning fuselages. At this point, the picture should look like the last 100-200 feet of a normal straight-ahead rejoin. After stabilizing (but not stopping) in this position, continue to move forward toward route and then into fingertip. Number 2 should attempt to accomplish the rejoin without crossing Number 1's 6 o'clock position.

Turning Tactical Rejoins:

1. **Turns into Number 2.** Even before Number 1 turns, excessive AA exists. Both lag pursuit and vertical turning room are required to decrease this angle. Number 2 should use no more than 10-15 knots of overtake during turning tactical rejoins due to increased bank angles. If stacked above Number 1, use vertical turning room above Number 1; if stacked below, use vertical turning room below Number 1.

   a. **Vertical Stack above Number 1.** In this case, increase power and pull the aircraft toward Number 1's high six. Visual contact will be lost momentarily, but since the maneuver is out of plane, no danger exists. When Number 1 disappears under the nose, roll the aircraft in the opposite direction to look for Number 1. Use caution not to turn the aircraft (just roll and look) as this will keep Number 1 under the nose. When the visual is regained, maintain heading toward the outside of Number 1's turn until forward LOS is detected. At this point, roll and pull toward the rejoin line. Be careful when crossing Number 1's 6 o'clock and remain clear of his or her jet wash. Once established on the rejoin line, follow normal turning rejoin procedures.

   b. **Vertical Stack below Number 1.** Make a level to slightly descending turn into Number 1 while maintaining airspeed. As Number 1 crosses the nose, reverse the turn to align the fuselages. This type of rejoin normally results in a flight path overshoot. As in an overshoot from a turning rejoin, pull to align the fuselages on the outside of the turn with aft LOS rate decreasing. Do not climb above Number 1. When stabilized on the outside of the turn, pull toward the rejoin line just before forward LOS develops.

2. **Turns Away From Number 2.** As soon as Number 1 turns, Number 2 is outside the turn and needs to maneuver to the inside of the turn with lead pursuit. Because distances used in tactical formation far exceed those used in previous training, Number 2 must monitor the airspeed and geometry closely. Excessive airspeed (greater than 10-15 knots of closure) and/or lead pursuit will result in an overshoot of the turning rejoin line, and a breakout will be necessary. Cross Number 1's six o'clock while remaining clear of his or her jet wash. Once inside Number 1's turn, use normal turning rejoin procedures.

905. WEDGE

Wedge formation can be used when terrain or tactics require an increased degree of flight maneuverability. The wedge position is primarily used in the low altitude environment. Turns do not need to be called. Number 2 will maneuver as required to maintain position. The wedge position is defined as 30-45 degrees off Number 1's 6 o'clock (3-4.5 AA) with a lateral spacing of 2,000 to 3,000 feet. It is the same cone as fighting wing but extended out to give the formation greater flexibility. Number 2 should stack up to 500 feet high (200 to 300 feet high is optimal) but will not fly lower than lead in the low altitude environment. Number 2 will fly no higher than 500 feet above Number 1 unless required to fly higher due to obstacle clearance during turns. Putting Number 1's aircraft on or below the horizon (no sky showing between the aircraft and the horizon) will ensure a positive vertical stack.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER TEN
USAF LANDING PATTERN

1000. INTRODUCTION

The VFR traffic pattern at USAF pilot training bases is different than NAS Whiting Field. At USAF locations, traffic pattern practice is generally done at home field, requiring different types of control and execution.

In this syllabus, sorties will include USAF pattern practice at nearby USAF airfields. You will get exposure to ground tracks, terminology, and execution.

In any traffic pattern, the runway is the primary visual reference. Each airfield has specific procedures designed to help prevent conflicts, assign traffic priority, and maximize training. Base-specific traffic pattern diagrams and ground references are contained in the local in-flight guide.

1001. OVERHEAD PATTERN – INITIAL & BREAK

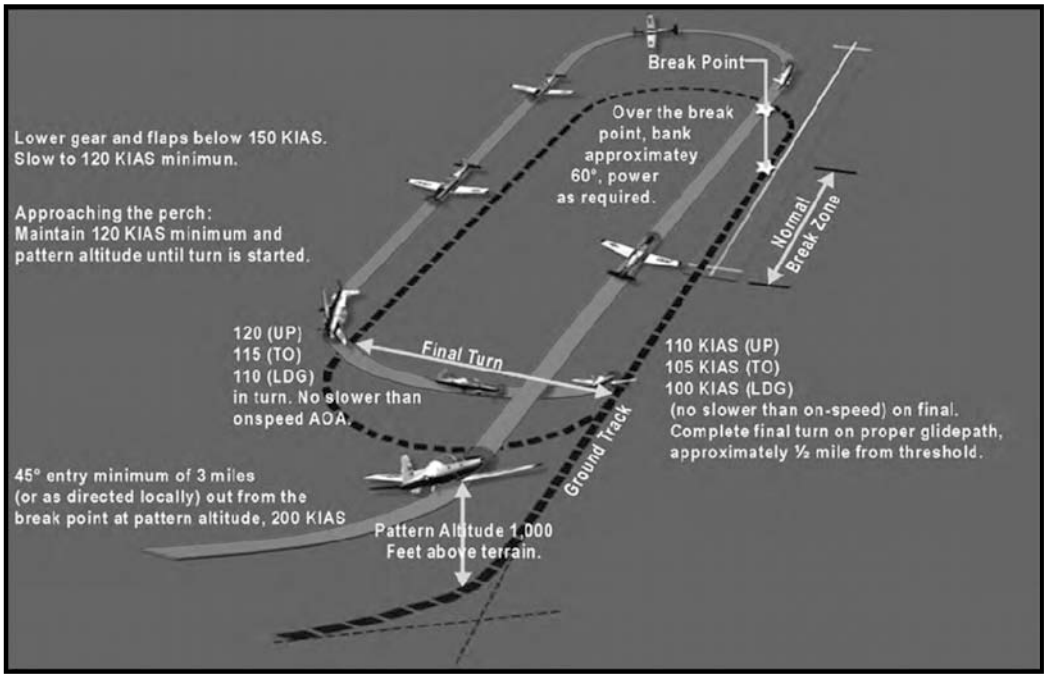

Figure 10-1 Overhead Break

INITIAL:

Objective. Align aircraft or formation with landing runway.

Description:

Airspeed - 200 KIAS.

Power - 54% torque.

Pitch - as required for level flight.

Altitude - 1,000-1,500 feet AGL or according to local directives.

FCP visual reference - one-half ground, one-half sky.

Wingman - opposite side of break direction.

Procedure. Follow depicted pattern ground track. On initial, align with the runway center line (or as directed). Make required radio call. Analyze winds.

BREAK:

Objective. Transition from initial to inside downwind.

Description:

180 degrees level decelerating turn.

Airspeed - slow from 200 KIAS to 120-150 KIAS.

Power - as required (approximately 10% torque).

FCP visual reference - drag TCAS antenna across horizon, HUD Flight Path Marker (FPM) as required. Expect required pitch to increase slightly throughout the break.

Wingman delays 5 seconds after Lead breaks.

Procedure:

The break zone is between the approach end and 3,000 feet down the runway. Wind conditions and traffic spacing will affect the actual point where you start the break. RSU or tower controllers may direct you to break at a certain point within or outside the break zone.

Smoothly roll into 45-60 degrees of bank and simultaneously adjust the PCL as required (approximately 10% torque). AOB and back pressure vary with wind conditions. Fly level, decelerating turn to inside downwind trimming control stick forces as the airspeed decreases.

On inside downwind continue to slow to 120-150 KIAS.

1002. INSIDE/CLOSED DOWNWIND

Objective. Maintain proper spacing and a ground track parallel to the runway. Apply drift correction and offset inside/closed downwind ground track into the wind to account for the effects of wind on the final turn. Arrive at perch point (similar to the 180 position) at 120 KIAS minimum, properly configured, and ready to perform a planned 30 degree bank final turn.

10-2 USAF LANDING PATTERN

Description. Airspeed - 120 KIAS minimum or according to local directives. Spacing references vary based on configuration and winds. Reference Figure 10-2.

Procedures:

On inside downwind approaching the perch point, with airspeed below 150 KIAS, make an intercockpit *"gear clear"* call and pause momentarily before moving the gear handle. There is no requirement for acknowledgement of *"gear clear."*

Lower the landing gear and flaps as required. As the flaps are lowered, the nose of the aircraft pitches up slightly due to the increase in lift. Maintain level flight by slightly increasing forward control stick pressure and trim for zero control stick forces.

Adjust power to maintain airspeed (120 KIAS minimum) and pattern altitude.

Adjust spacing and perch point for winds.

Figure 10-2 Pattern Spacing References

Outside Downwind. Outside downwind is flown when maneuvering back to Initial for the break or to set-up for a VFR straight-in. At the departure end, instead of pulling closed to inside downwind, turn crosswind and extend. Every pattern has different outside downwind distances flows due to aircraft performance. On outside downwind, you will have the option to set-up for the break or proceed inbound with a straight in.

1003. PERCH & FINAL TURN

Objective. Use a descending 180 degree turn to align aircraft with the runway. The final turn is complete when wings level on final.

Description. For a no-wind pattern, the desired perch point occurs when the touchdown point is at approximately 45 degrees aft of the wing line.

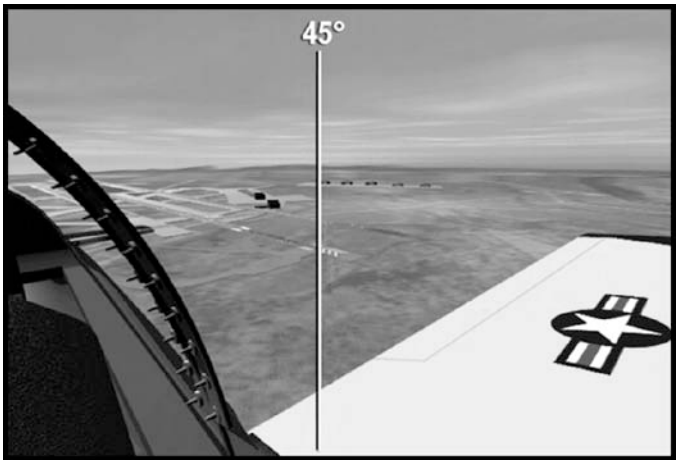

Figure 10-3 Perch Point Visual Reference

Procedure:

Confirm aircraft configuration prior to or at the perch. Pattern altitude may vary from 800 feet AGL to 1500 feet AGL. Expect to arrive on a slightly longer final (1500-2500 feet). Use power as required to maintain appropriate airspeed based on configuration.

If any doubt exists about the safety of continuing the approach, go around. ***Do not hesitate to disregard the ground track and use traffic pattern stall recovery procedures if required.***

Halfway through the final turn, cross-check aircraft altitude, which should be approximately 450 feet AGL for a 800 foot pattern, 600 feet AGL for a 1,000 foot pattern and 800 feet for a 1,500 foot pattern. The phrase “half way down, half way around” is often used to describe this point.

Formation:

Number 2 should mirror all calls by Number 1. Maintain adequate spacing throughout pattern and final turn. Do not let spacing get excessive. On the last touch & go, Number 2 should consider executing a low approach if excessive spacing exists. This will aid in the rejoin when departing the pattern.

1004. CLOSED PULL-UP

Objective. Maneuver aircraft to inside downwind to perform multiple practice patterns and landings. Minimize fuel and time used for a normal pattern.

Description. A climbing turn to inside downwind from initial takeoff, touch-and-go landing, or go-around.

Airspeed - 140 KIAS minimum.

Bank - 90 degrees maximum.

Power - as required (normally maximum initially).

Procedure:

At 140 KIAS minimum and according to local directives, request clearance for a closed traffic pattern.

When approved, clear and advance the PCL smoothly to maximum, and start a climbing turn to the downwind leg, initially using approximately 60 degrees of bank. Downwind leg displacement should be the same as established with an overhead break.

Approaching pattern altitude, reduce power to prevent acceleration.

Keys to success:

Begin a climbing turn and pull the nose up until horizon is between the rudder pedals.

Lead the level-off on inside downwind by retarding the PCL to approximately 20% torque. As a guide, begin power reduction 100 feet below pattern altitude for every 10 KIAS in excess of 140 KIAS. For example, if airspeed is 180 KIAS, start power reduction 400 feet below pattern altitude.

Bank may be increased to 90 degrees to affect level off, if vertical speed is excessive. During excessively nose-high pull ups, a small amount of rudder in the direction of the turn will help bring the nose back to the horizon.

On inside downwind, reduce power to maintain 140-150 KIAS until approaching the perch.

1005. GO AROUND PROCEDURES

Description. A go around is the same as a waveoff.

Procedures. Safety is enhanced by an early decision to go around if required. Do not delay the decision and do not try to salvage a bad approach. Execute IAW T-6B Contact FTI waveoff procedures. The gear and flaps will be retracted when executing a go around.

1006. PATTERN BREAKOUT

USAF pilot training bases have established pattern procedures with designated entry and exit points. A pattern breakout is similar to a discontinued entry and may be made from numerous points in the pattern (the perch, inside downwind, etc.). Follow the local procedures for breaking out. To perform a breakout, add power to maximum, while starting a climbing turn away from the runway. Then raise the gear and flaps, and confirm a clean aircraft prior to 150 KIAS. Level off at breakout altitude and fly toward the VFR entry point. Make the appropriate radio call when able. Upon reaching the VFR entry point, start a descending turn to ensure the aircraft is wings level at pattern altitude at the VFR entry point.

Use initiative and judgment when deciding to break out of the pattern. Exit the traffic pattern immediately; do not wait to be directed to break out if a dangerous situation is developing. If directed to break out, follow instructions without hesitation. Use caution when breaking out from the inside downwind leg due to slow airspeed and configuration. Never break out from the final turn; execute a go-around.

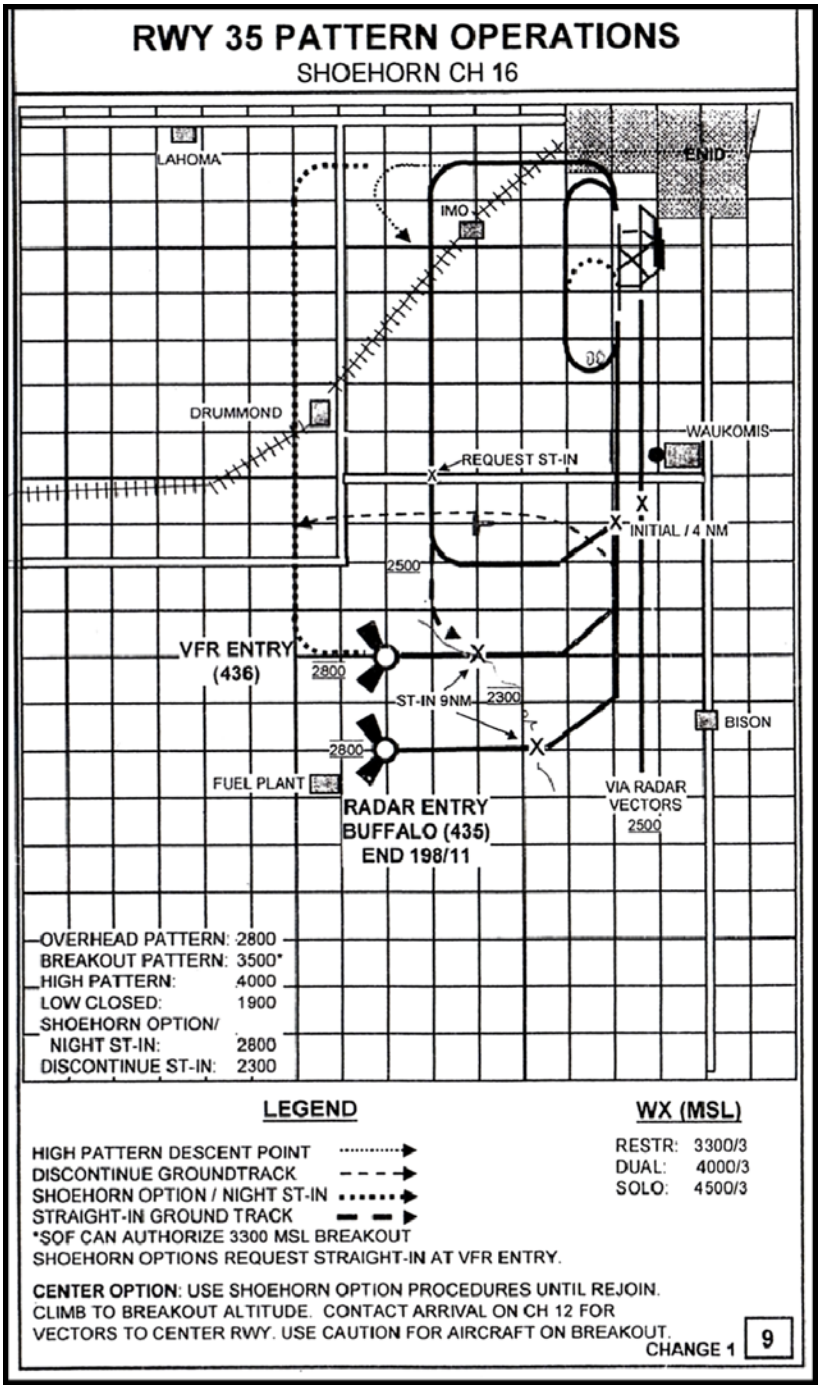

Figure 10-4 Example Vance Traffic Pattern

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A
GLOSSARY OF TERMS USED IN THIS SYLLABUS

Angle Off (AO): The angular difference between the longitudinal axes of two aircraft.

Aspect Angle (AA): The angle measured from the tail of Lead's aircraft to the position of the Wingman; can be expressed in degrees or clock position. The tail of Lead's aircraft is an aspect of 0, the nose is 18 (180 degrees). Any perpendicular position of the Lead is a nine aspect (left wingtip, right wingtip, top of canopy, center of wings underneath).

Blind: No visual contact with other aircraft in the formation; opposite of "visual."

"Bingo" Fuel: Prebriefed fuel state which allows aircraft to return to base or alternate, if required, using preplanned recovery parameters and arriving with normal recovery fuel.

Closed: Successive takeoffs and landings/low approaches where the aircraft does not exit the landing pattern.

Closure (Positive or Negative): Relative velocity of one aircraft in relation to another. Also know as V_c (pronounced V sub C).

Corner Velocity: The minimum speed at which an aircraft can attain maximum allowable G. This is the speed where you can attain maximum turn rate and minimum turn radius on the aircraft.

Flight Crew Information File (FCIF): The FCIF is a file of cards containing each squadron pilot's name. Every pilot has their own FCIF card; signing off the last entry in the FCIF book acknowledges you have read the latest entry. This is similar to the student read file except that you cannot fly or perform Runway Supervisory Unit (RSU) duties [USAF Wheels-Watch] until the card is up to date. If you have not signed off the last FCIF, you will not get an airplane. Variations include the Safety Aircrew Read File (SARF) and the Aircrew Read File (ARF) or Pilot Read File (PRF).

Formal Release: You and your classmates will spend all day at the flight line (about 10-12 hours per day); you will all brief in a mass brief in the morning and you will all release at the end of the day together; the end of the day is called "formal release."

Flying Training Unit (FTU): This is where you will transition to your weapon system after pilot training.

Heading Crossing Angle (HCA): Same as angle off.

High Six: A position above and behind Lead.

Lag Reposition: An out-of-plane maneuver to control overtake, decrease AA, or prevent an overshoot by increasing vertical turning room on the lead aircraft using a lag maneuver.

"Joker" Fuel: Prebriefed fuel state at which an event is terminated and the transition to the next phase of flight begins.

Lag Pursuit: Lag pursuit (nose behind the Lead) can build turning room, increase range, and control overtake. Although there can still be some closure, angle off will increase and AA will decrease up to the Lead's flight path. Lag pursuit will appear like you are going to pass behind Lead.

Lead Pursuit: Lead pursuit (nose in front of Lead) decreases range towards Lead. Aspect Angle and closure increase, angle off decreases. Lead pursuit will appear like you are going to pass in front of Lead.

Lift Vector: A line through the center of the fuselage perpendicular to the wings.

Line of Sight (LOS) Rate: Speed of apparent movement of another aircraft in relation to your aircraft.

Lead reposition: An out-of-plane maneuver to create closure using lead and acceleration techniques.

No Joy: Lack of visual contact with other aircraft not in the formation; opposite of "tally."

Pure Pursuit: Pure pursuit (nose on Lead) increases closure (but at a more moderate rate than lead pursuit). Pure pursuit will cause you to be on a collision course with Lead.

Plane of Motion: An imaginary plane defined by the aircraft's flight path.

Radial G: The vector sum of the aircraft's lift vector and gravity.

Sequential Closed: Formation breakup to closed pattern with Formation Wingmen taking appropriate spacing behind Lead prior to closed pull-up.

SOF (Supervisor of Flying): The SOF is an Instructor Pilot who sits in the tower and monitors and is there mainly for emergencies and weather recalls.

Tally: Visual contact with other aircraft not in the formation; opposite of "no joy."

Turn Circle: The flight path described by an aircraft in a turn.

Turn Radius: The distance between an aircraft's flight path and the center of the turn circle.

Turn Rate: The degrees per second at which an aircraft is turning.

Turning Room: The space available to turn your aircraft in relation to another.

Visual: Visual contact with other aircraft in the formation; opposite of "blind."

A-2 GLOSSARY OF TERMS USED IN THIS SYLLABUS

APPENDIX B
USAF FORMATION VISUAL SIGNALS

ACTION	PREPARATION	EXECUTION
Afterburner in or out: ***Note: Not required during formation takeoff.***	Move clenched fist inboard or outboard as appropriate.	Nod head.
Attention in the air:		Execute rapid shallow rocking of wings.
Battle Damage Assessment (BDA) Check:		Hold clenched fist with index finger and thumb extended, back of hand towards canopy. Wingman responds by executing prebriefed BDA check.
Change Lead:	Make several forward pointing motions, then hold up Number of fingers to indicate present position of the point (position) which is to assume the lead.	Pilot of aircraft assuming the lead nods head.
Echelon to the Right or Left:		Dip wing to the right or left, whichever is appropriate.
Echelon Turn:		Extend clenched fist with forefinger and little finger extended upward for each echelon turn performed.
*Flaps Up or Down: ***Note: During a formation takeoff, preparatory or execution signals are not required for raising flaps.*** Initial gear movement on the flight lead's aircraft may be used as the wingman's signal for gear and flap retraction.	Hand flat, fingers forward, downward motion of hand from wrist to lower flaps - reverse motion to raise flaps	Nod head.
Fuel Check:		Close fist with the thumb extended and perform drinking motion with thumb touching the oxygen mask.

Fuel Remaining for like type aircraft:		In response to Fuel Check. Extend one finger for each 1,000 lbs. of fuel board. Extend finger(s) vertically for 1,000 to 5,000 lbs.; horizontally for 6,000 to 9,000 lbs. After signaling 1,000 lbs. increments, pull hand out of sight, then signal 100 lbs. increments in the same manner. Signal zero with closed fist. For example: To signal 6,300 lbs., extend one finger horizontally (indicating 6,000 lbs.); pull hand out of sight (indicating a change from thousands to hundreds); and extend three fingers vertically (indicating 300 lbs.).
*Fuel Remaining for dissimilar aircraft:		In response to Fuel Check. a. Less than 10 minutes remaining: Use the "Land Immediately" signal. b. For more than 10 minutes, use up to five fingers to indicate each 10 minute increment of fuel as follows: 1 finger = 10-19 minutes 2 fingers = 20-29 minutes 3 fingers = 30-39 minutes 4 fingers = 40-49 minutes 5 fingers = more than 50 minutes
Gear Down:	Downward motion with a closed fist, thumb extended downward.	Nod head.
Gear Up: ***Note: During a formation takeoff, preparatory hand signals are not required for raising the gear.***	Upward motion with closed fist, thumb extended upward.	Nod head.
Jettison Stores:	Hold fist at top of canopy and make several pumping motions.	Nod head.

B-2 USAF FORMATION VISUAL SIGNALS

Lanyard Check:		Show hooked index finger.
Loosen Formation:		Fishtail the aircraft.
Oxygen Check: ***Note: If the response is not an OK, use the radios or appropriate HEFOE signal.***		Cup hand over oxygen mask, followed by query in the form of an OK sign (circle formed by touching ends of thumb and forefinger, other fingers extended).
Pitchout:	Make a circular motion with vertically extended index finger.	
Radio Frequency Change:		Tap helmet near ear with fingers extended. Extend finger(s) vertically for digits 1 through 5, horizontally for digits 6 through 9, pulling hand down out of sight between digits. Signal zero with a clenched fist. Ensure signals are made against a visible background. For example: a. Present channel change - tap helmet, extend appropriate number of fingers for channel desired, pulling hand down out of sight between digits. b. Prebriefed manual frequency - tap helmet, hold up clenched fist next to helmet. c. Manual frequency not prebriefed - tap helmet, hold up clenched fist next to the helmet, extend appropriate number of fingers for frequency desired, pulling hand down out of sight between digits.
Ready for Takeoff:	After run up, the leader looks at the wingman.	Wingman nods head yes or no.
Reform or Tighten Formation:		Rock wings slowly.
Run up Engine for Takeoff:		Make a circular motion with vertically extended index finger.

*Speed Brake(s) in or out:	Biting motion with hand; fingers and thumb opening and closing.	Nod head.
Start Engines:		Extend arm over head and make a circular motion with the hand.
Start Takeoff Roll:	Lead places head back toward headrest.	Lead nods head for brake release. For aircraft equipped with afterburner, after the aircraft are rolling straight down the runway, a second head nod is a signal to light afterburner (unless after-burner light up is initiated simultaneously with brake release).
Tactical Formation:		Make a series of porpoising maneuvers, spacing as briefed.

DISTRESS SIGNALS

INTENTION / PROBLEM	SIGNAL
Approach End Cable Engagement:	a. **Escorted:** Extend tail hook. Escorting aircraft will relay intent. b. **Unescorted:** Fly parallel to the active runway at 1,000 feet above the field elevation with tail hook extended. Rock wings until reaching the departure end of the runway, turn to downwind and check tower or mobile control for light signals. If a straight-in cable engagement must be flown, flash landing light on final.
*Bailing Out or Ejection:	One or both clenched fists pulled downward across the face to simulate pulling an ejection face curtain.
Descend to Lower Altitude:	Hold hand at top of canopy, palm down, fingers extended and joined, move hand forward and down.
*Desire to Land:	Movement of the hand, flat, with palm down, forward and downward, finishing the movement in a simulated roundout. As an alternate signal, lower the landing gear.
Electrical Failure Landing (no assist aircraft available):	Distressed aircraft will fly 500 feet over the tower or mobile control, then continue to the far end of the runway and pull up into a wide downward leg. Proceed with a landing and pattern approach for the type of aircraft being flown while watching the tower or mobile for signals. The control tower will clear the area of other aircraft and will call emergency crash equipment to the scene.
I Must Land Immediately:	Close fist and hold it to top of canopy with thumb extended downward, then move arm up and down rapidly. Do not confuse with "GEAR DOWN" signal, which is generally not used at altitude.

I Must Land on Your Wing:	Pat shoulder, palm down. To prevent confusion with other signals, use right hand and left shoulder or vice versa. To acknowledge, other pilot must give the OK signal; the basic signal indicates a jet approach speed of 130 KIAS. If the distress aircraft desires a higher approach speed, the pilot must raise one finger for each 10 knot increase desired. The distressed aircraft lands and the escort executes a go around.
Intercepting Signals:	The intercepting aircraft positions itself in front of and usually to the left of the intercepted aircraft and rocks its wings. This is a signal that the interceptor wishes the other aircraft to follow it. A responding irregular flashing of all available lights in this case indicates distress.
Radio Failure:	Tap microphone or earphone of helmet and signal as appropriate: a. Receive Failure: With palm of hand over the ear position, move hand forward and backward. b. Transmitter Failure: With palm of hand toward and in front of the face, move hand up and down.
Radio Inoperative Landing (no assist aircraft available):	Fly aircraft along the side of the landing runway, 1,000 feet above the field elevation, rocking wings until reaching end of the runway. Turn to downwind and check the tower or mobile control for green light on base leg and final approach for landing clearance.
System Failures (HEFOE System):	Clench fist and hold it at top of canopy, then hold up the required number of fingers to denote which system is involved. If the clenched fist signal is seen but no finger signal is seen or the intercepting pilot is unable to understand the signal given, the pilot will assume the aircraft in distress has one or more systems inoperable and should proceed with caution. ***NOTES:*** 1. For use only when radio is inoperative or not available. 2. Day visual signals.

	The receiving pilot acknowledges the signal by repeating it: a. Hydraulic - one finger b. Electrical - two fingers c. Fuel - three fingers d. Oxygen - four fingers e. Engine - five fingers ***Note: For multi-engine aircraft, point to the side, left or right, that corresponds with the engine failure.***

THIS PAGE INTENTIONALLY LEFT BLANK